July

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# Science and Invention

IN PICTURES

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САМОЕ ЛУЧШЕЕ ВТОРАЯ ЧАСТЬ

# A Modern Pyramid

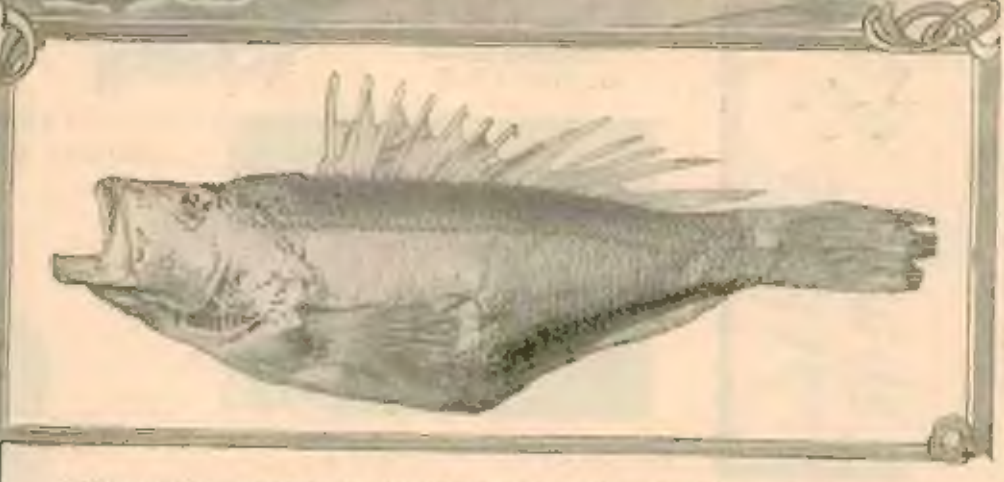
By OLIVER S. ARATA

AMERICA is to have an obelisk. It will be 130 feet high and is already being erected of concrete on a peak of the Ozark Mountains in Arkansas. The construction is being paid for by Mr. William H. Harvey, who assumes that in twenty thousand years from now this civilization will be destroyed and that a new group of nations will have been established. Mr. Harvey then advises that if you scoff at this idea, you list to the lesson taught by history. The ancient Egyptians also scoffed when a wiser man told them that their great civilization would be lost. The pyramid, the approximate cost of which will be $25,000 when completed, is being erected at Monte Ne in Benton County, Arkansas, on solid limestone rock. The base is to be 40 feet square. In the room just above the limestone rock, which will be 16 feet square, many unique and valuable features and records will be placed. Descriptions of airplanes, circulation of blood, railroads, the phonograph, electricity and numerous other modern inventions are to be placed in one of the three airtight chambers, two of which are to be in the shaft of the pyramid itself.

Our artist's conception of the opening of the tomb 20,000 years from now is shown in the illustration herewith. Radio television will enable the world at large to see what is going on at any important place. Individual flying machines will make busy bees of us all. Even inter-planetary trips will become frequent and regular occurrences.

# Twentieth Century Mummies

By HUGO GERNSBACK
Member, American Physical Society



THE art of embalming was carried to a high degree by the old Egyptians as is well known. Egyptian mummies have survived the ravages of time and air for thousands of years. The method that was used by the Egyptians is briefly as follows:

An opening was made in the lower abdomen and the entrails taken out. A special tool was used whereby the entire brain was taken from the skull through the nose. After the body had been steeped for forty days in natron (solution of sulphate carbonate and chloride of sodium), it was ready for embalming. The interior of the body was filled with bitumen, spices, gums and natron, after which the mummy was ready for wrapping and for the tomb.

In our present illustrations the writer proposes a twentieth century mummy with its up-to-date means of preserving the human body for thousands of years to come. The writer resorts to electro-plating the entire body. In order to be sure of the theory, he went to the trouble to first try it out on a 12½-foot fish shown in the illustration. The insides of the fish were first taken out, the fish then filled with wax, dried and finally covered with graphite in order to make it conductive to the electric current. It was then placed in an electro-plating bath which plated it entirely with copper in such a way that every scale and fin is clearly preserved. Not a detail was lost. Afterwards the fish was silver plated over the copper.

The same process can be used for human beings without any trouble. Anyone who is fastidious and does not like to think of his body being disintegrated and wishes to preserve it in a mausoleum for thousands of years to come can now have his body electro-plated after his death at an expense that is not prohibitive. In the case of the fish it took four days to complete the electro-plating process which necessarily had to be slow in order to faithfully preserve all the details of the scales, fins, etc.

The price of electro-plating a human being will not be in excess of $60 to $75 for a solid casting of copper from 1/8" to 1/4" thick, the price naturally being higher for a heavier plating. In the case of a human being the process would be slightly different. After the body had been thoroughly cleaned and dried and made proof against the ravages of the air and time by certain embalming fluids and substances, the body would then be coated with a thin covering of paraffine or other impervious wax. The wax would then be covered with graphite in order to make it conductive before placing the whole in the plating bath. By means of this process the contour, facial expression and even the hair will be faithfully preserved for posterity, the entire body being covered with a solid sheathing of metal. It will therefore be impossible for air to enter into the inside of the shell and preservation of the body will be well nigh perfect.

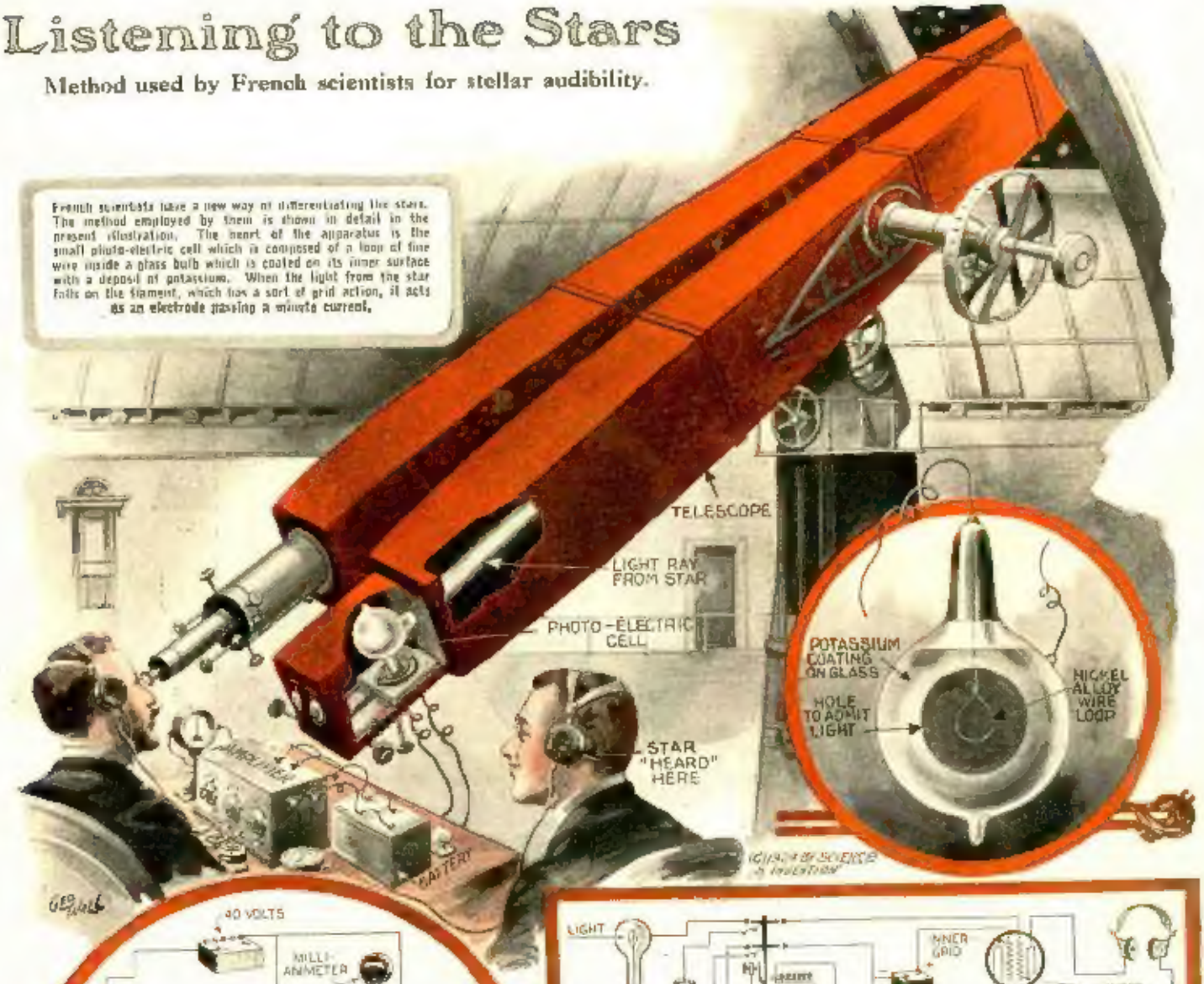
The writer makes the suggestion that some of our great immortals should be thus preserved. They could then be enclosed in glass coffins so that people could view them and study them, thereby receiving a good idea of exactly how they appeared in life.

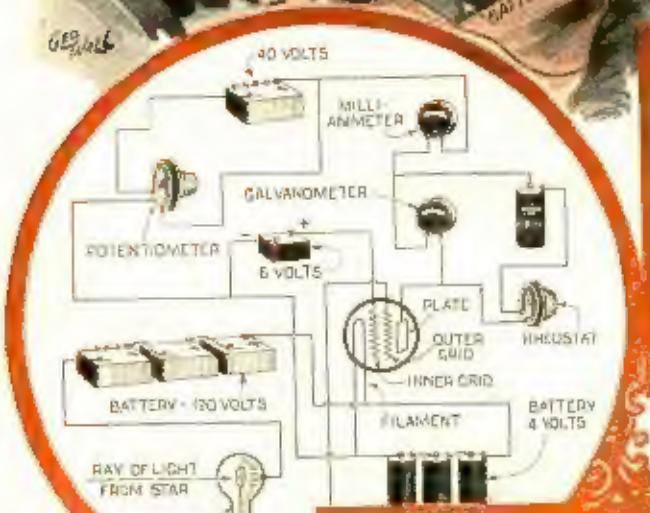
Copper-plating has been chosen because the process is both cheap and efficient. It goes without saying, however, that some of our more fastidious millionaires will probably have themselves gold or platinum plated, or at least have a heavy gold-plating over the copper.

# Listening to the Stars

**Method used by French scientists for stellar audibility.**

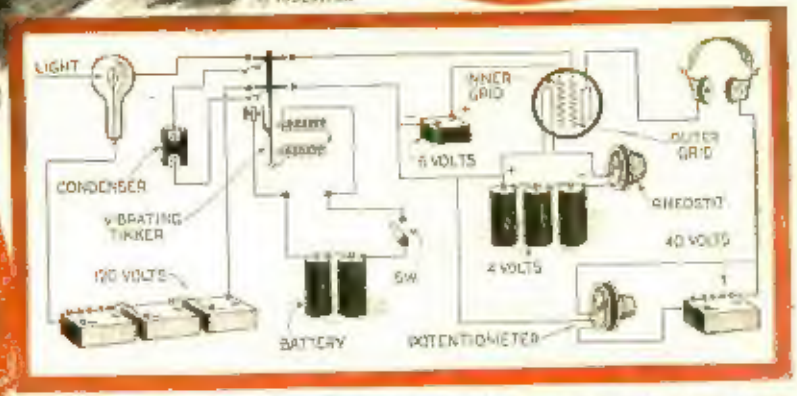
French scientists have a new way of differentiating the stars. The method employed by them is shown in detail in the present illustration. The heart of the apparatus is the small photo-electric cell which is composed of a loop of fine wire inside a glass bulb which is coated on its inner surface with a deposit of potassium. When the light from the star falls on the filament, which has a sort of grid action, it acts as an electrode passing a minute current.



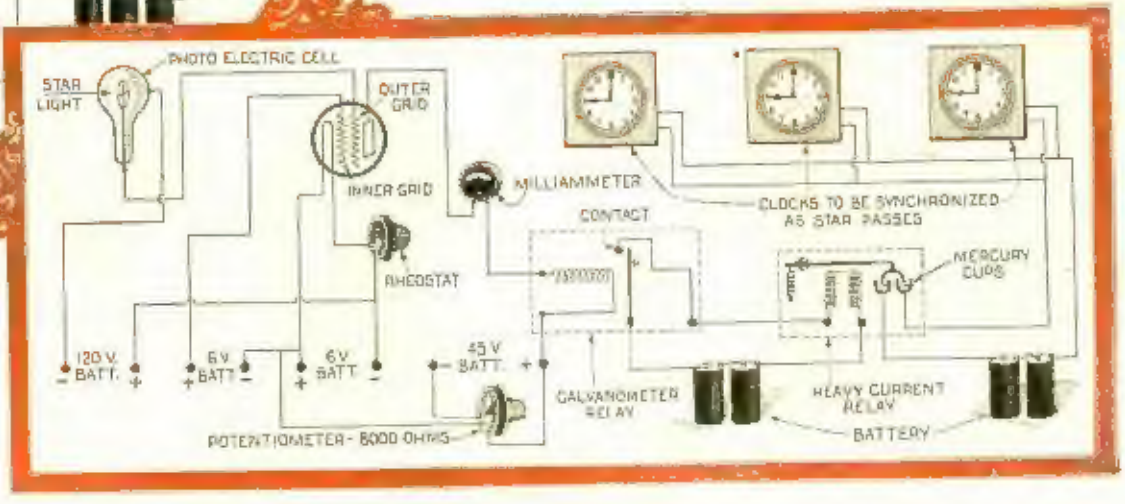




The circuit above shows double grid audion connected with a photo-electric cell and sensitive galvanometer. With this arrangement different stars gave different deflections on the galvanometer, depending upon the strength of the light from the star.

The circuit at the right shows how clocks may be synchronized as a star passes the Meridian. As a star passes and impresses its light upon the photo-electric cell, a current pulse passes through the galvanometer relay, closing the clock synchronizing circuit.

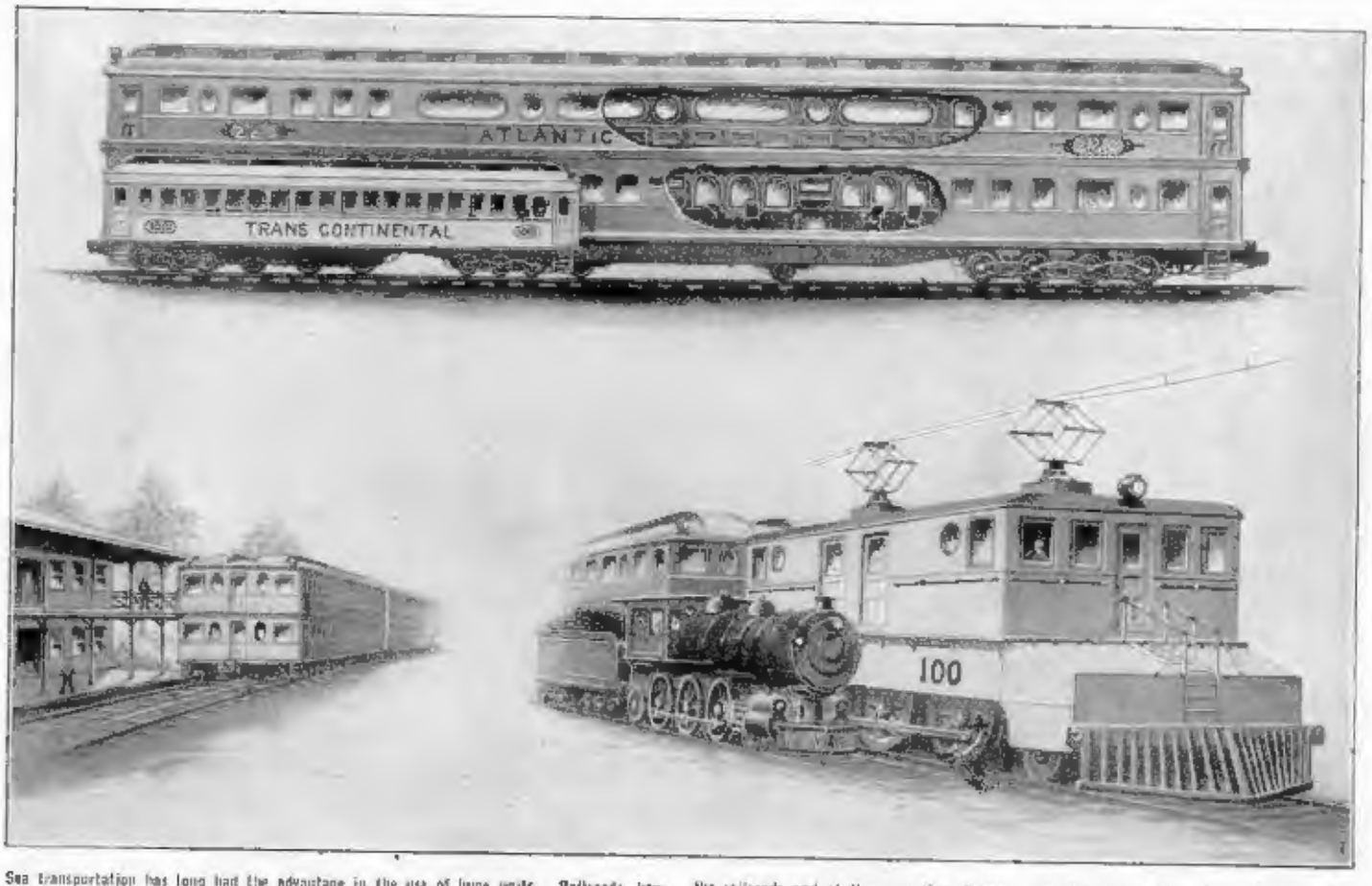



The circuit above shows how a tinker was employed to charge and discharge a condenser into a circuit connected with a special double grid vacuum tube. The sounds heard in the phones comprised a series of ticks. Different stars gave different strengths of sound.



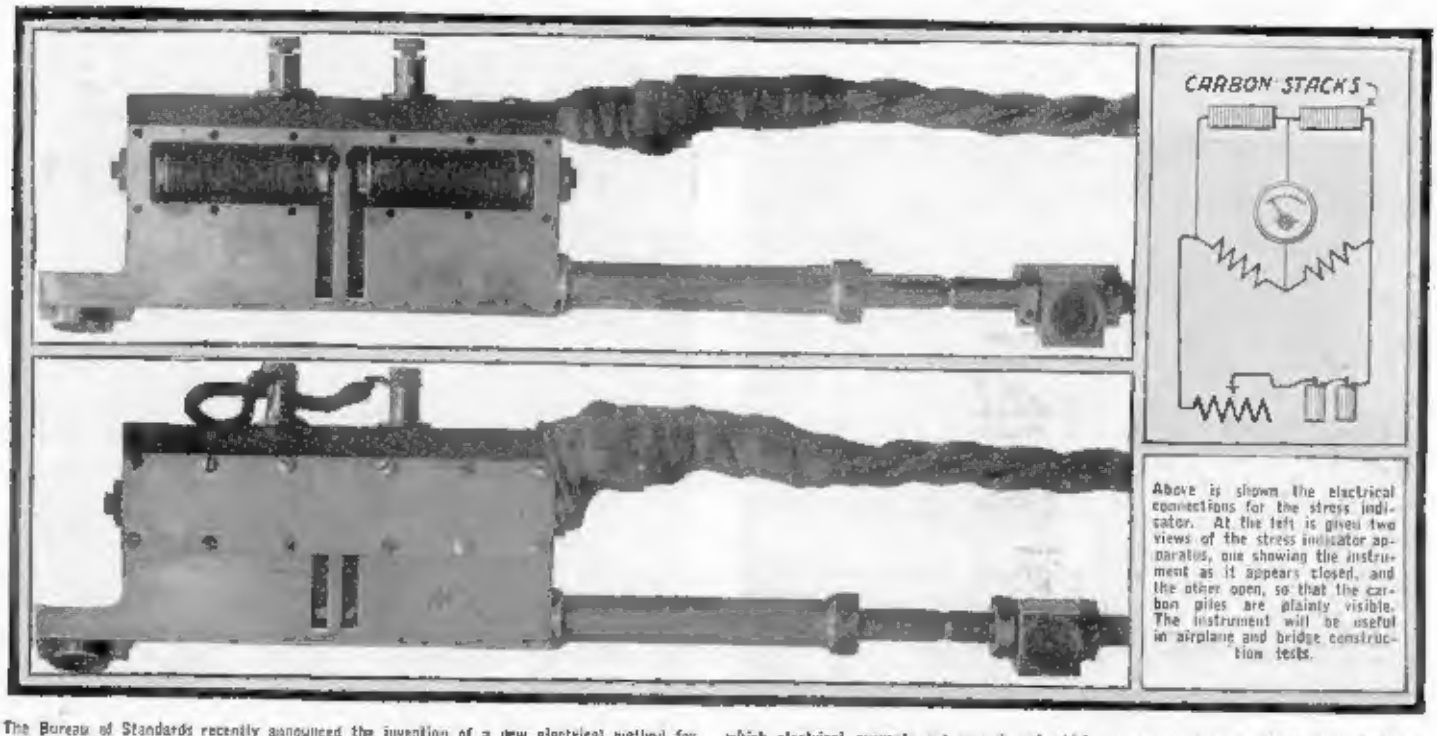
# Railroads of Tomorrow

By GEORGE F. MURPHY




Sea transportation has long had the advantage in the use of huge units. Railroads, however, are now using only slightly larger transportation units than those which were in vogue at the inception of the industry. With the constantly increasing operating costs and the steady approach of travel to the point of saturation, particularly on eastern railroads, something must be done in the near future to increase the carrying capacity of the railroads and at the same time decrease operation costs. The scheme given here is a logical one to perform this service. At the top of the illustration is shown the passenger car of the future for carrying at least 8 times the present number of passengers. Below is a comparison of the huge electric locomotive of the future and its present steam counterpart. The gauge of the future railroad will be 2½ or 3 times that used at present.

# ELECTRICAL STRESS MEASUREMENTS




Above is shown the electrical connections for the stress indicator. At the left is given two views of the stress indicator apparatus, one showing the instrument as it appears closed, and the other open, so that the carbon piles are plainly visible. The instrument will be useful in airplane and bridge construction tests.

The Bureau of Standards recently announced the invention of a new electrical method for measuring stresses which promises to be of the utmost importance in civil engineering work. The device is comparatively simple consisting of 2 piles of carbon disks, through which electrical currents are passed and which are measured by a differential or bridge method. The amount of current passed varies directly with the amount of pressure transmitted to the carbon piles, thus giving a proportional indication. —S. R. Winters.

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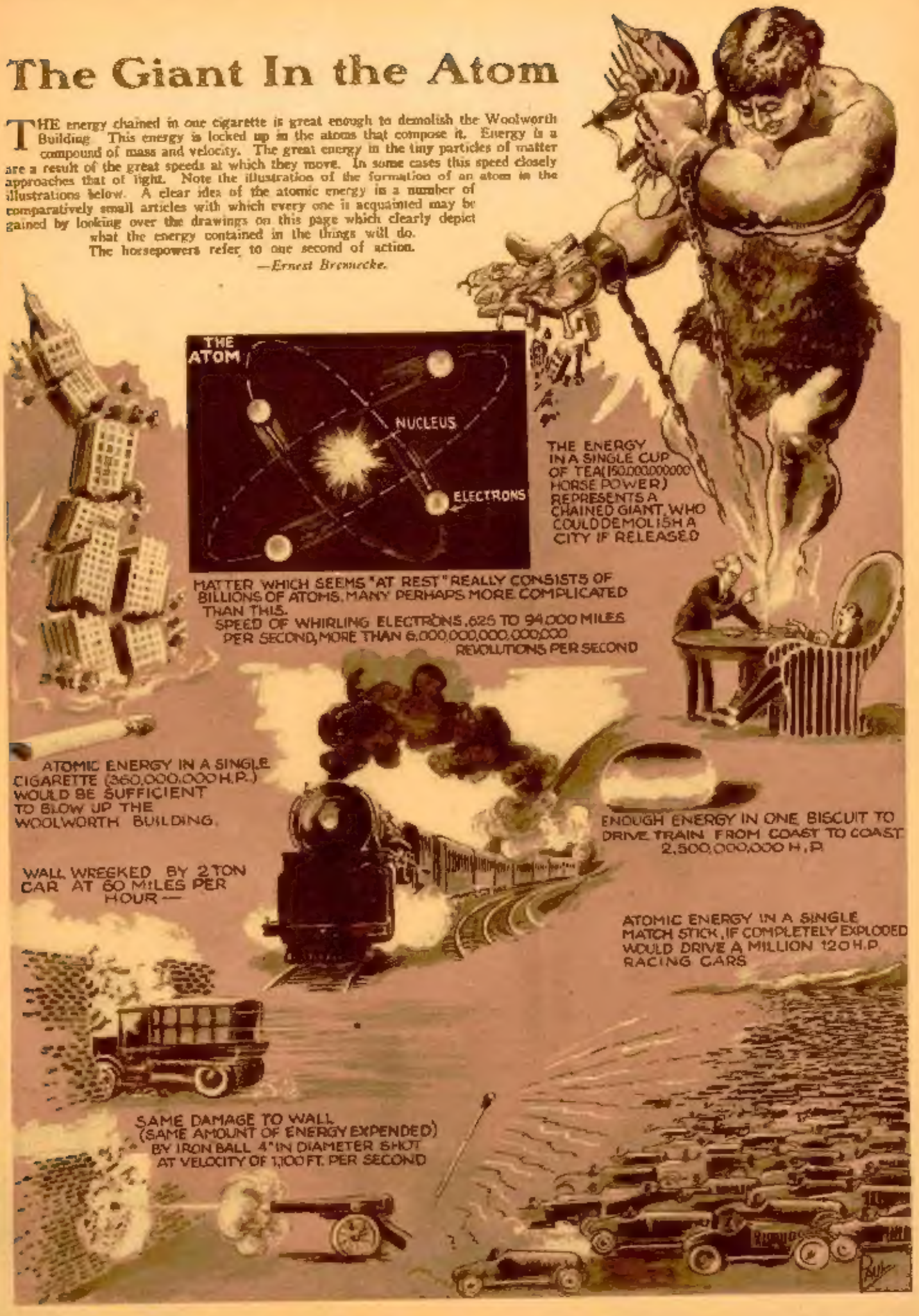
# The Giant In the Atom

THE energy chained in one cigarette is great enough to demolish the Woolworth Building. This energy is locked up in the atoms that compose it. Energy is a compound of mass and velocity. The great energy in the tiny particles of matter are a result of the great speeds at which they move. In some cases this speed closely approaches that of light. Note the illustration of the formation of an atom in the illustrations below. A clear idea of the atomic energy in a number of comparatively small articles with which every one is acquainted may be gained by looking over the drawings on this page which clearly depict what the energy contained in the things will do.

The horsepowers refer to one second of action.

—*Ernest Brennecke.*



August

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# Science and Invention

FORMERLY

ELECTRICAL EXPERIMENTER

ELECTROCUTING SHARKS

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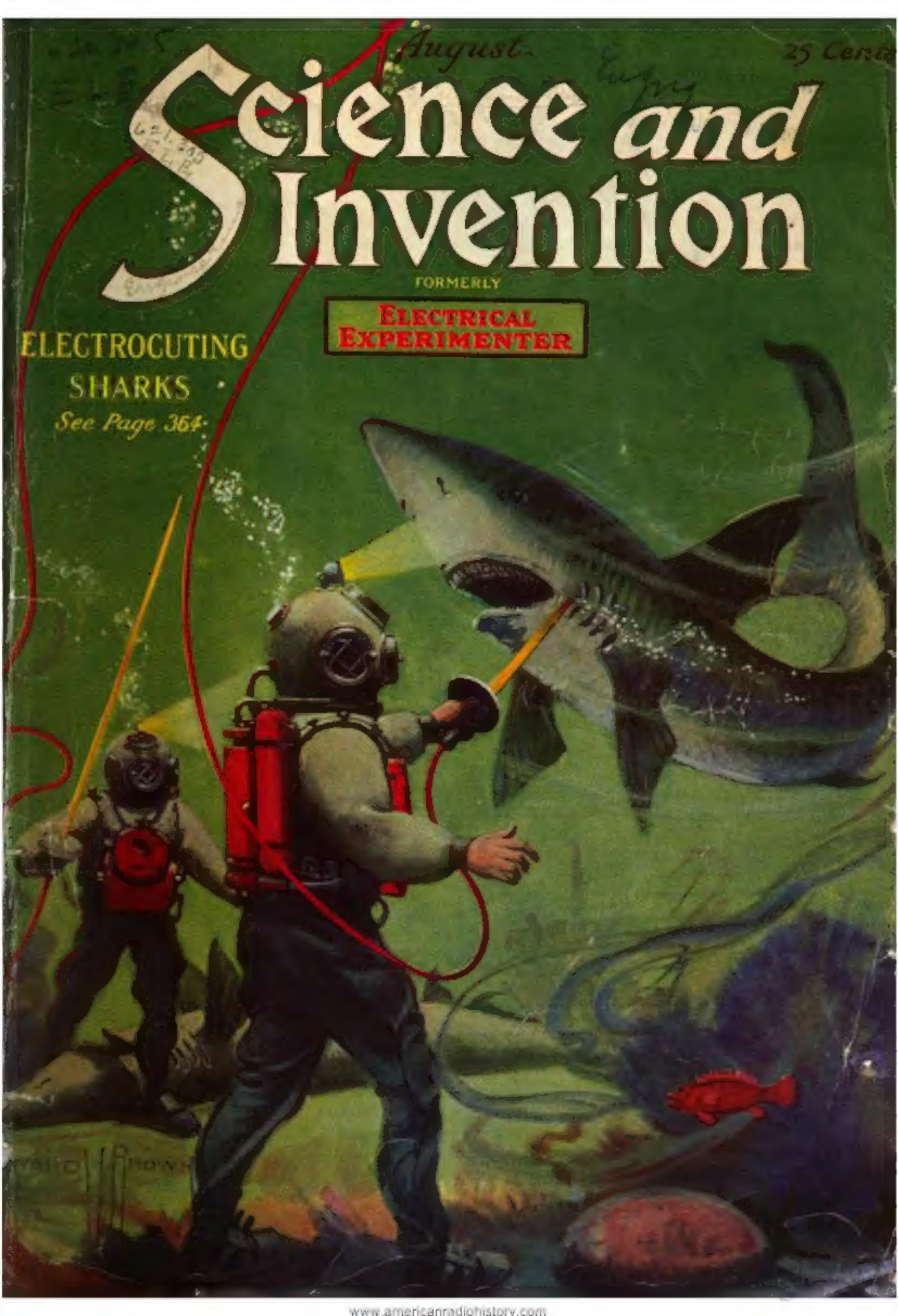

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H. GERNSBACK – EDITOR
H.W. SECOR – ASSOCIATE EDITOR

AUGUST
1926
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# Electric Sand-Hog to Salvage Ships

## By ERIC A. DIME

THE recovery of treasures from the bottom of the sea has been a dream of inventors since times immemorial. The wrecks, which rest in the silt and sand of the ocean's floor, have served as an incentive to men to devise ways and means whereby the hidden wealth could be raised and salvaged. The idea of lifting sunken vessels is now receiving possibly more attention than it ever did in the history of the world. The reason for this is the immense tonnage of ships lost during the World War.

According to well-informed authorities, it is claimed that the vessels sent to Davy Jones' locker, while the hosts of the fighting nations were contending supremacy on land and sea, represent a tonnage of 15,000,000. The monetary value involved in this tonnage is about eight billion dollars, which is a sum greater than the national debt incurred during our Civil War. To make the comparison more striking and interesting it might be said that this staggering sum is greater than the total output of gold in the United States, and it is in excess of the wealth taken from the diamond mines of South Africa during their entire period of exploitations.

It is not only the ships, lost during the war, which are attracting the attention of salvaging interests, but also those that are lost annually through unavoidable maritime accidents. In European waters and along our Atlantic coast the ocean's bottom is strewn with hundreds of wrecks which could be salvaged if a proper equipment were employed for raising the vessels. There is nothing new or remarkable about raising wrecked ships. Such feats are taking place practically all the time. According to statistics at hand, altho they are not of recent date, we find that up until August of last year the salvage department of the British Admiralty had recovered 440 vessels sunk during the war. These ships represented a value of $250,000,000.

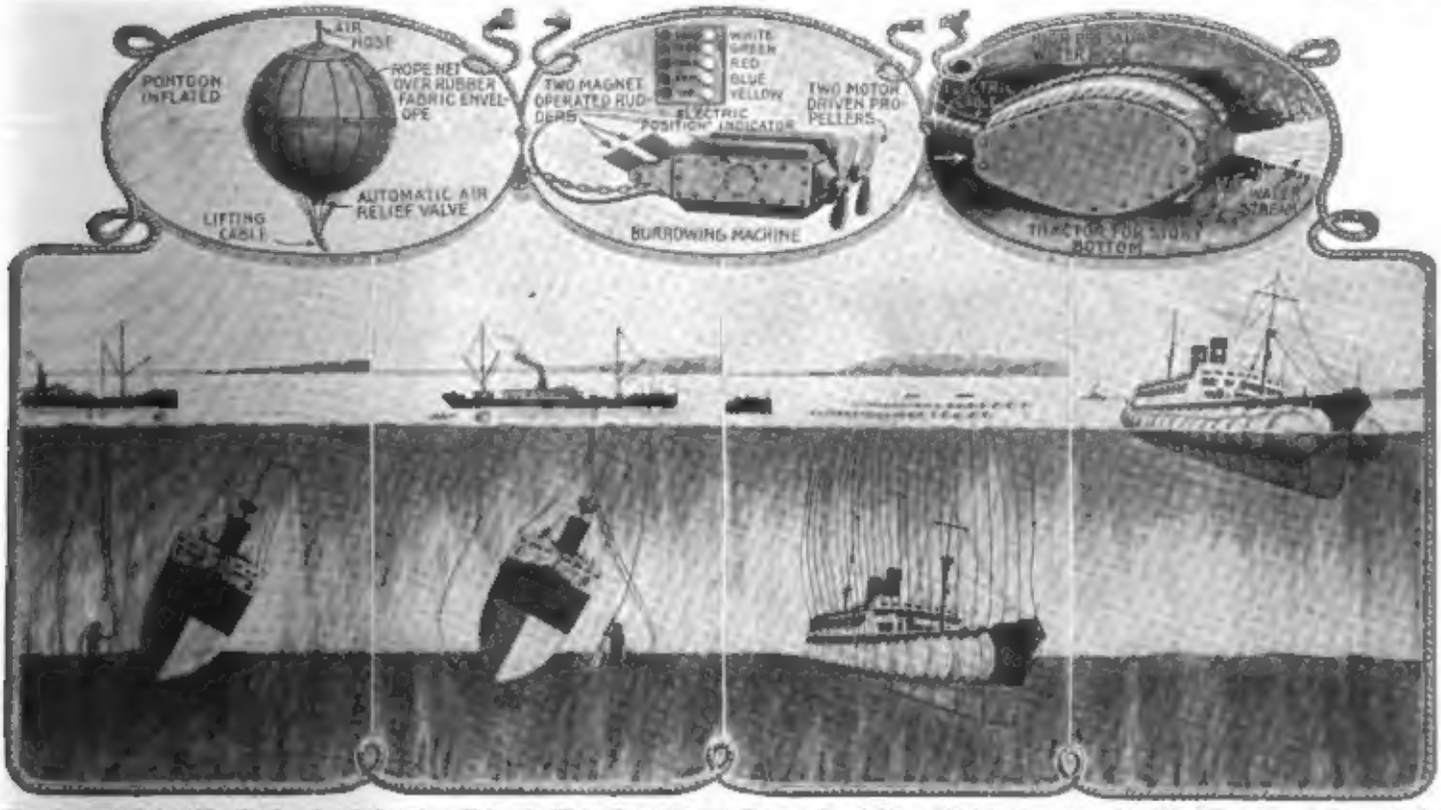
The ships, which so far have been raised, are those resting in shallow waters or at depths of about 100 feet. Wrecks, which are lying at depths of from 200 to 300 feet or more have up until the present time remained where they are, because there has been no satisfactory method employed whereby such vessels could be lifted from the ocean's floor. It is conceded that any ship could be raised, provided a sufficient number of pontoons could be attached to the vessel for lifting purposes. But the drawback so far has been the lack of supports for holding the pontoons in position and allowing them simultaneously to give a direct upward lift sufficient to raise the ship.

### THE ELECTRIC SAND-HOG INVENTED.

A device to overcome all these difficulties has recently been invented by a New Yorker, a Mr. A. B. Saliger, who has spent several years in perfecting a machine that is unique in construction and from all appearances practical in application. He calls it the *burrowing machine*, and it is so different from anything else used for the salvaging of ships that he has been granted basic claims on it. As its name implies the *burrowing machine* is employed to dig its own way thru sand, silt and gravel in which a wreck rests on the ocean's bottom. The device is made to carry or haul a line under the hull of the ship, and when that is accomplished it is an easy matter to string heavy cables under the vessel and then attach the pontoons to the cables for lifting purposes.

The *burrowing machine* resembles a double torpedo, or two torpedoes joined together like a pair of Siamese twins. The front has two propellers, some fifteen inches in diameter, rotating in opposite directions. The machine is 4 feet wide, 2 feet high and 5 feet long. The rear is equipt with a pair of horizontal rudders, very much like those of a torpedo. The main body of each sec-

(Continued on page 434)




The Latest Scientific Device for Salvaging Ships Is This Electrically Driven Sand-Hog, Which Burrows Its Way Down and Around the Ship, Permitting Cables to Be Past About the Hull. Finally, Pontoons Are Fastened to These Cables and Inflated, Lifting the Ship.



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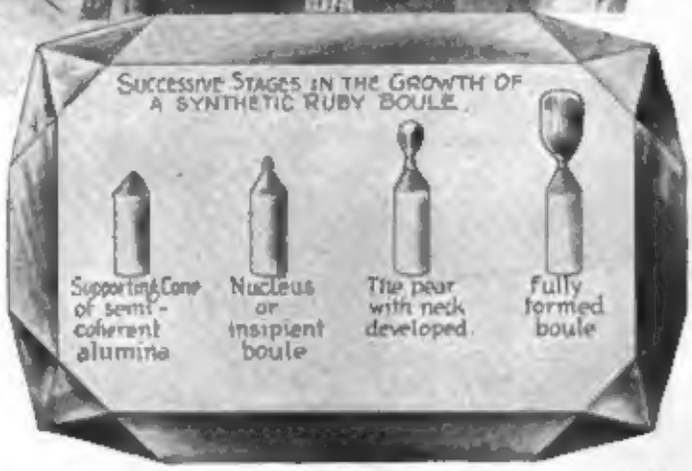
# Man-Made Rubies

By O. IVAN LEE, B. Sc.

## The Wonderful Story of the Artifical Ruby that Rivals the Genuine Stone in Lustre, Hardness and Color

Photo at Left Shows Two Large Ruby Boules in the Collection of Columbia University, New York City. The Boule at the Extreme Right Shows Fracture Cracks Caused by the Unequal Expansion and Contraction and Set-Up Particularly by the Rapid Cooling of the Outer Surfaces of the Boule. From These Boules the Most Perfect Rubies Imaginable Are Cut.

For Centuries the Ruby Was "the Gem of Gems." Some of the Greatest Tragedies in History Have Occurred Because of the Desire to Possess Famous Rubies. But Today Every One Can Have a "Ruby." The Inset Photo at the Left Shows One of the Famous Oxyacetylene Gas Furnaces in Paris, France, Where the Synthetic Rubies Are Made by the Thousand.




The Progressive Diagram at the Left Shows the Successive Stages Gone Thru by the Synthetic Ruby Chemist in Building Up the Chunk of Precious Glass-Like Substance From Which Future Rubies Are To Be Cut to Adorn the Fingers, Arms and Necks of the Fair Sex. Synthetic Rubies Are Available in All Sizes Up to 60 Carats.

FROM remotest times, an ever accumulating lore of gems and precious stones has been past on from generation to generation, and altho prosaic science has classified and card-indexed this vast array of heterogeneous information, not yet has it completely explained or eradicated that primitive impulse which attracts us irresistibly to stones which sparkle. There is still something of the savage in all of us; and it may be that **things which glitter appeal to the same instinct which finds a fascination in flames.**

**Of the many varieties of gems which have stood the acid test of the world's favor, the diamond and the ruby easily lead, for if the former is the premier of jewels by reason of its hardness and fire, the latter is the peer of all colored stones—tinged as it it with the hue of the blood which gives us life. They are thus symbolical of the evolution of the race which has struggled upwards thru centuries of fire and blood—their very existence may be mineralogically paraphrased in the Darwin theory as the "survival of the hardest."**

No doubt coincident with the growth of a traffic in gems was their extensive imitation, for since the beginning of time, the possession of anything rare, beautiful, expensive or exclusive has been a challenge to duplication with something just as good, and *cheaper!*

The Egyptians and Romans were skilled in imitating precious stones, indeed, the art of making glass owes much to this base incentive, and their skill was made the foundation of a craftmanship which in later ages produced counterfeits of which the buyer **had ever to beware.**

**The science of mineralogy developed during the Nineteenth Century did much not only to systematize the classification of gems and make easier their identification, but, since mineralogy is a handmaiden of chemistry, a new hope was born—not that of imitating, but actually *creating* the gems themselves. Heretofore, with the debatable exception of pearls which had been produced in the Orient by introducing foreign matter into the pearl forming mollusk, all the attempts at counterfeiting had been frankly *imitative*. In the light of exact chemical knowledge of gem materials, the possibility of reproducing their substance was now seen, and from this conception has been painfully evolved a true miracle of the atoms—the commercial manufacture of veritable rubies.**

### WHAT THE RUBY IS.

Essentially, the ruby is the oxid of the modern and indispensable metal, aluminum. It occurs naturally as the mineral *corundum*, a familiar variety being the abrasive *emery*, which, however, contains in addition a large proportion of iron. Before going further, it should be explained that practically all gem stones when absolutely pure are colorless, the particular color which a certain kind of stone may possess is then accidental and not inherent, and merely a detail of the problem of reproducing its *characteristic substance*.

Boiled down, then, making a true ruby necessitated only the making of transparent alumina, that is, apparently, merely *fusing* it.

Under ordinary conditions, aluminum oxid becomes liquid in the vicinity of 2,000 C. (3,632 F.). The fusion of alumina was actually accomplisht over a hundred years ago, for it is recorded in 1819 that if two



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rubies were exposed on charcoal to the flame of an oxy-hydrogen blowpipe, they could be melted thereby into a single bead. The pioneer experimenters and their followers, endeavoring to make rubies were evidently so engrost in trying to make *crystalline* alumina and so beset with their individual difficulties, that they could not see the woods for the trees and for a long time never realized the value of its hint which lay at hand.

By purely chemical methods, numerous workers were successful in producing crystallized aluminum oxid, but since in each case the crystals obtained were exceedingly thin and often microscopic, the material obtained could not be utilized for cutting. If the reader has ever had the opportunity of examining a well crystallized piece of that synthetic abrasive *par excellence*, carborundum or silicid of carbon, it will have been noticed that the hexagonal crystals are excessively thin, compared to their diameter. The writer has before him a particularly pure such specimen in which the crystals are perfectly transparent and of a beautiful emerald green color. They are harder than the ruby and nearly as hard as a diamond. One of them measures half an inch in diameter. But for the fact that they are scarcely thicker than the paper on which this is printed, there is little doubt that carborundum would be a popular synthetic gem, having no existence in the mineral kingdom, barring the fact that it has been found in meteorites. This, then, illustrates the form of the crystalline rubies obtained by the fusion methods, and why they were unsatisfactory.

One chemist fused alum and potassium sulfate, another alumina and borax, a third aluminum fluorid and boric acid, and clever improvements were made on the principle involved in these reactions, the object of which was to crystallize aluminum oxid from a lower melting solvent or flux, just as salt is deposited from a concentrated brine solution. In spite of slow cooling, lasting not infrequently for weeks, no commercially available material was made, and the small crystals obtained were very costly.

In the latter part of the 19th Century, one of the would-be ruby makers re-discovered the fact that rubies could be fused, or, more correctly, *welded*—but not until some years later was it found that welded rubies were crystalline in structure and not amorphous like glass. On this account the value of the discovery was again overlooked.

With the general introduction of the oxyhydrogen flame, renewed efforts had been made to fuse aluminum oxid into transparent corundum, but without success. Quartz, which melts higher, was fused, but the alumina, altho clear as long as under the flame, persistently became opaque when the test was removed. One of these experimenters, after years of fruitless endeavor has recorded his belief that it was impossible to achieve the desired material because of this tendency. It had been found, too, that aluminum oxid virtually sublimes; that is, the melting point and boiling point were so close together that the alumina suddenly becomes fluid and then quickly boils away. This fact has mitigated against the employment of the electric furnace in making rubies.

### THE FIRST RECONSTRUCTED RUBY APPEARS.

All these difficulties were very discouraging, and so, one by one, the workers gave up the quest as hopeless. One day, however, rubies were offered for sale in Europe, whose source could not be satisfactorily accounted for. It was said in explanation that a ruby mine had been discovered near Geneva, Switzerland, but eventually the secret came out. It seemed that a Swiss priest had been experimenting with natural ruby chips obtained from the lapidaries, had fused these fragments into larger stones, cut them and circulated them as mined rubies—which was perfectly true in one sense. Naturally, the profit was a handsome one. These *reconstructed* rubies, as they are termed, are even yet an article of commerce, and altho the technique of their manufacture has been much improved, they are still inferior in color, tenacity and structure to the artificial ruby of which they were the forerunners; that is, the *synthetic* ruby.

Since it was now conclusively demonstrated that natural alumina could be successfully fused, it only remained to apply the same process to chemically prepared material and the honor of perfecting this industrially belongs to Prof. Verneuil, of Paris; but it must not be imagined that his task was an easy one or that anyone could have turned the trick.

### THE GLORY OF THE CHEMIST—THE SYNTHETIC RUBY.

The machine now used is a special type of oxyhydrogen blowpipe producing a temperature of from 1,900 to 2,400 C. (3,452 to 4,352 F.). The blowtorch is built of two concentric tubes, the inner one of which carries oxygen, the hydrogen passing thru the annular space between the two tubes. The gases are supplied from convenient tanks. The torch is placed in a vertical position and the powdered aluminum oxid placed in a little box with a sieve for a bottom and opening directly into the oxygen tube. This is one of many ingenious and all-important details which Prof. Verneuil devised, for it can be readily appreciated that a blast of flame directed on a pile of light and non-coherent alumina powder would blow it away before it had any opportunity to attain a welding temperature. A little hammer, actuated by electromagnetic means,

(Continued on page 416)

Photos Courtesy of Haller & Ives

The Top Tray Here Shown, Represents One of the Most Interesting Collections Ever Gotten Together. It Shows the Ingredients or Chemicals Used to Produce "Synthetic" Rubies in the Fierce Heat of the Crystallizing Flame and Thereafter, the Successive Stages in Forming and Cutting Various Shapes. The Lower Tray Shows Several Dozen Varieties and Shapes of "Synthetic" Rubies, Each One of Which so Closely Resembles a Genuine Ruby Obtained from Mines, That Even Experts Are Fooled Unless They Have the Very Highest Precisional Instruments. No Average Jeweller Could Tell by Looking at Them, Whether or Not They Are the Celebrated Genuine Ruby. The Electroscope or Ultra-Powerful Compound Microscope Only Will Tell the Difference. They Are of Exactly the Same Hardness and Invariably Possess the Same Lustre and Color as the Stone Gotten from Mother Earth, Except That Instead of Requiring Hundreds of Years in Which to Crystallize and Form, These Scientific Rubies Took but a Few Moments to Make in the Skillful Hands of the Modern Chemist.

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# 100 H.P. Voice for Conventions

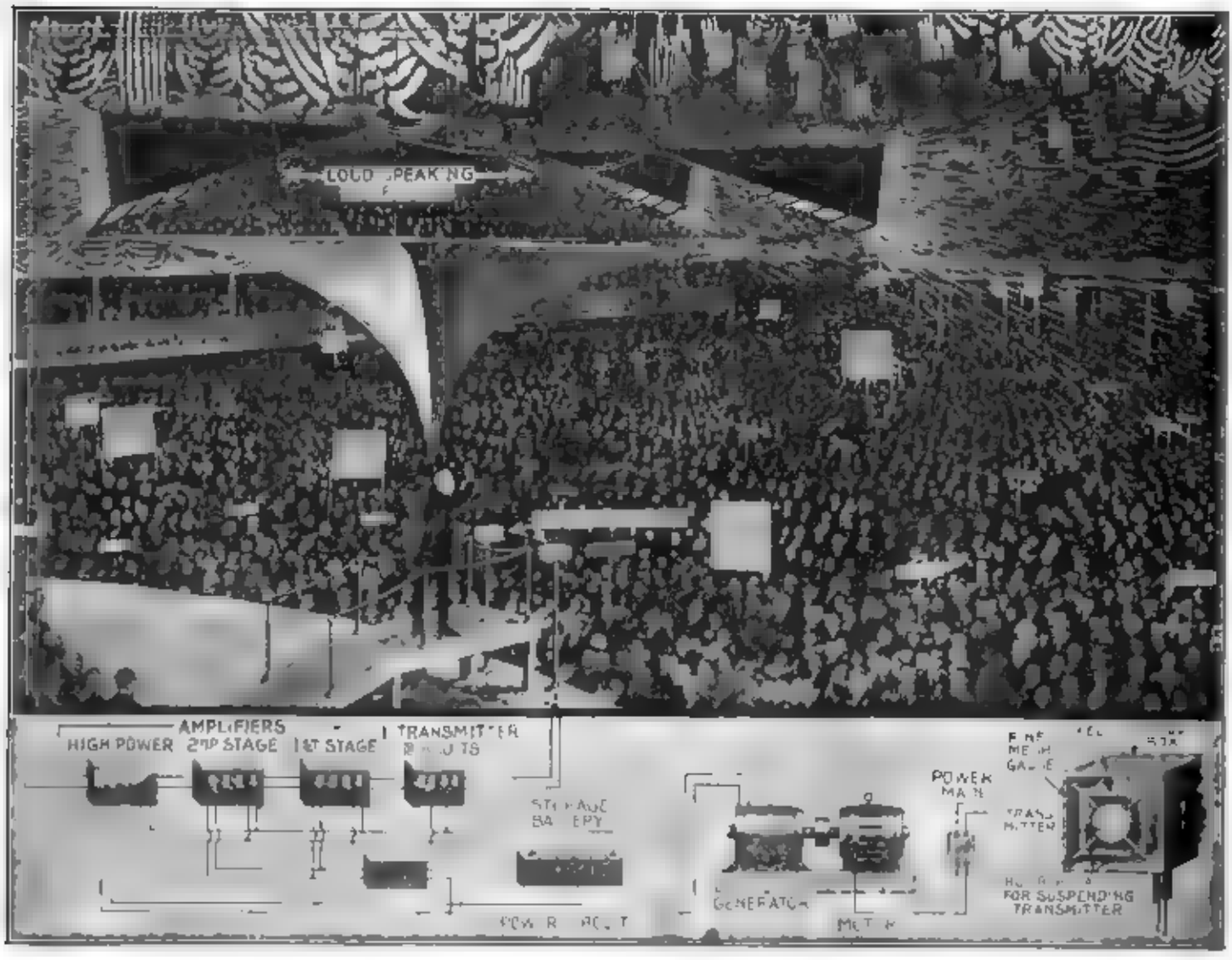
FOR the first time in its history the attendance at the Republican National Convention was too large to hear the speaker's voice. So now electricity, in the guise of the *loud-speaking telephone*, wraps its strength around the voice of the orator and gives it power and volume to reach the distant auditor with all its expression and its timbre intact. National conventions have depended more on visual rather than audible interest. There has, of course, been a chorus of applause which all could hear, but much of what has been said was read rather than heard even by those who were present.

Just in time for the Republican Convention the engineers of the Bell Telephone System successfully completed a voice magnifying apparatus embodying newly discovered features of telephony, which the inventor of the telephone could not have foreseen. In the Coliseum's vast auditorium the experts of the American Telephone and Telegraph Company, the Western Electric Company and the Chicago Telephone Company worked for ten long days installing the intricate apparatus thru which electricity, the master magician, served clear and distinct sound to the occupants of the most distant seats. There was little to see of the miracle-working mechanism in the great convention hall. An inconspicuous transmitter of speech, raised up a few feet from the front of the speaker's platform, and overhead were suspended several receivers, rectangular wooden horns, ten feet long, with their open ends pointed towards various parts of the auditorium. The flags and bunting were still the conspicuous eye-catchers. Without seeing how it is done, the audience found that as far as hearing was concerned the great crowd was telescoped by the public address system in close proximity to the speaker's platform. Under the floor and behind the walls ran the wires which lead to and from the *Audion speech magnifying apparatus*, itself hidden away in an unseen part of the building.

The loud speaking telephone system which the Bell System placed in the Coliseum at Chicago, and in the San Francisco convention also, has been in process of development for about ten years. The experiments have been numerous and of great scientific interest, but there has also been a romantic side to the work, which was mostly done in the laboratories of the Bell System, situated on one of the busiest and noisiest waterfront streets in New York. Amidst all the rattle and bang of a thousand teams and motor trucks pounding the stone pavement, teamsters thinking of nothing but their right-of-way were startled to hear a strange voice, apparently close to their ears, deliberately and clearly counting above all the confusion, "one, two, three, four," or reciting some rhyme like "Hickory, dickory, dock, the mouse ran up the clock." Those teamsters could hardly see the horn on the roof of the lofty laboratory building, nor guess that tests were being made which would facilitate the nomination of a presidential candidate. The best the teamsters could do was to wonder how they could hear these tests in spite of the nearest load of angle iron which was clattering over the cobbles.

On a foggy night a little group of Bell telephone engineers crossed the Hudson River and from the roof of the Pennsylvania Station listened while the same ryth-

(*Continued on page 441*)




**The Republican and Democratic Conventions Both Had the Assistance of "Madame Science" This Year in the Guise of a Powerful, Loud-Talking Telephone. Fitted With Audion Amplifiers, These Loud Talkers Enabled Everyone in the Crowd of 15,000 People to Hear the Speakers—Even the Women, Who Usually Do Not Talk as Loud as the Men.**

# Marvels of the Ear

## By JOSEPH H. KRAUS

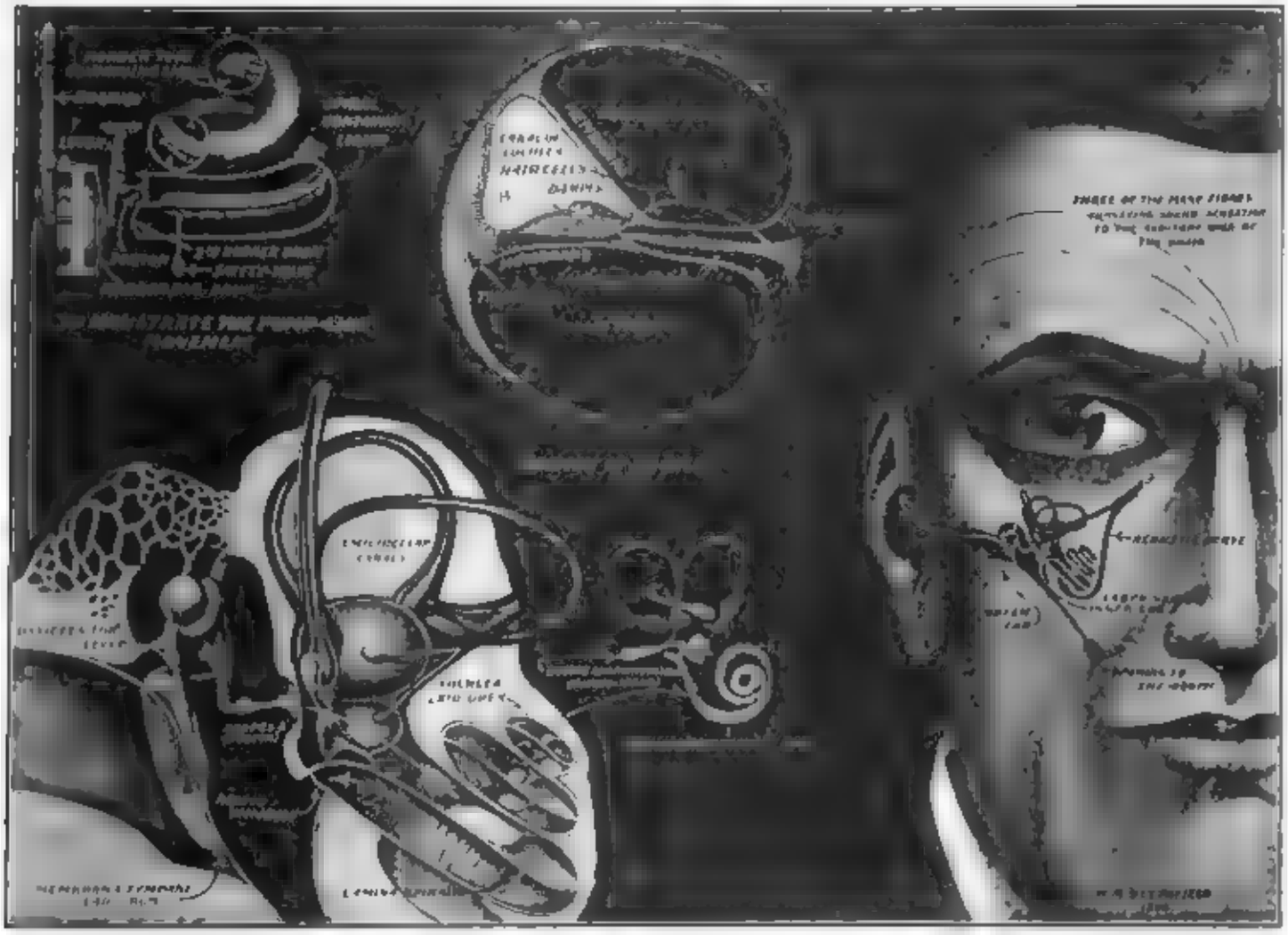
IN a previous discourse on sound in this journal we have learned of several of the more novel surprises in the world of sound, which not only interest everyone, but which are at the same time not generally known. Perhaps no more wonderful study has ever presented itself than the subject of "how we hear"—and even to-day this function is not very clearly understood.

### How We "Hear"

The auditory organs themselves are divided into three parts, *external, middle* and *internal ear.* The foremost one we shall not consider at the present time to any great extent, because it serves only a slight function in hearing. This consists of the ear (the external ear or the one which we see) and the tube or canal entering the side of the head up as far as the drum. It can be *entirely absent* and not affect hearing except that localization of the position from whence any particular sound comes is lost considerably.

Sound, as has been said, is of vibratory nature, and when impinging on the drum of the ear, medically known as the *tympanic membrane,* we get a rise and fall of pressure; thus an increase in pressure will force that membrane inward and the fall favors its outward motion.

In contradistinction with other membranes this membrane in the ear has no vibratory sound of its own; in other words, *has no period.* If it had one, it would undoubtedly vibrate in resonance with some particular sound to which it is attuned, and we would get a false impression of intensity. However, being made cone-shape and having a convexity outward with its fibers of construction running circularly and radially and in addition to the fact that it is tightly stretched, it follows that each and every portion of the cone will have a different period of vibration and the whole diafram will be aperiodic.



The Above Illustration Gives Us a Representation of the Action of the Ear Which Will Be More Clearly Understood by the Analogy at the Upper Left-Hand Corner. Here We Find a Spiral Tube Divided Into Two Parts by Means of a Rubber Tube and a Partially Solid Wall, Each Filled With Liquid. The Upper Part Communicates With the Lower at the Top of Its Spiral. When Any Movement of the Pump Handle Is Produced, the Rubber Ear Drum Moves a Certain Definite Distance, Which Is Amplified Thru the Lever Arrangement and the Smaller Cross Sectional Area of the Second Piston. This Compresses the Liquid Contained in the Upper and Lower Spiral Tubes Communicating That Pressure to the Lower Part Where the Second Rubber Drum (Round Window) Bulges Outwardly. The Pressure Also Has an Effect Upon the Rubber Tube Compressing the Liquid Within It and Sometimes Causing a Flow Into the Safety Valve, the Rubber Tube Itself Is Made Up of Flexible Walls, the Bottom Part of Which Has a Series of Strings Along Its Length. Its Strings Are Thus Caused to Vibrate In This Way Exciting Little Cells Upon Them and Giving Us the Sensation of Sound. In the Diagram to Its Right We See the "Rubber Tube" Marked "Canal of Cochlea." The Strings Are Located In the Lower Membrane With the Hair (Sensitive) Cells Upon Them, and a Damper to Prevent Excessive Vibration. By Comparison With the Anatomical Diagram, the Analogy Will Be Readily Seen.

#### BROKEN EAR DRUM DOES NOT PRODUCE DEAFNESS.

Many people have thought that the ear drum, if broken, produces deafness. Strange as it may seem, such is not the case, and medical authorities have established the fact that even the entire absence of the ear drum will not produce deafness, altho it does effect keenness of perception of auditory sensations of a slight nature.

The function of the canal is merely to assist in keeping out insects and dust, being lined with hair and also to maintain an even temperature at the drum. Between the drum and the internal ear is a chain of tiny bones situated in the intermediate division; this division is called the *middle ear.* These bones connect the large membrane or drum with a small membrane 1/20 its size.

This latter membrane has been termed the *oval window* (fenistra ovalis), and as our diagram indicates, the bones themselves are combined into a powerful lever action which multiplies the force of the drum movement. This movement tho in its amplitude is diminisht two-thirds, the pressure at the end (oval window end) is therefore naturally increased one and a half times thru the bone action alone.

(*Continued on page* 422)

Volume VIII.
Whole No. 89

Science and Invention

H. GERNSBACK – EDITOR
H.W. SECOR – ASSOCIATE EDITOR

SEPTEMBER
1920
No. 5

# Moving Platforms for Street Crossings

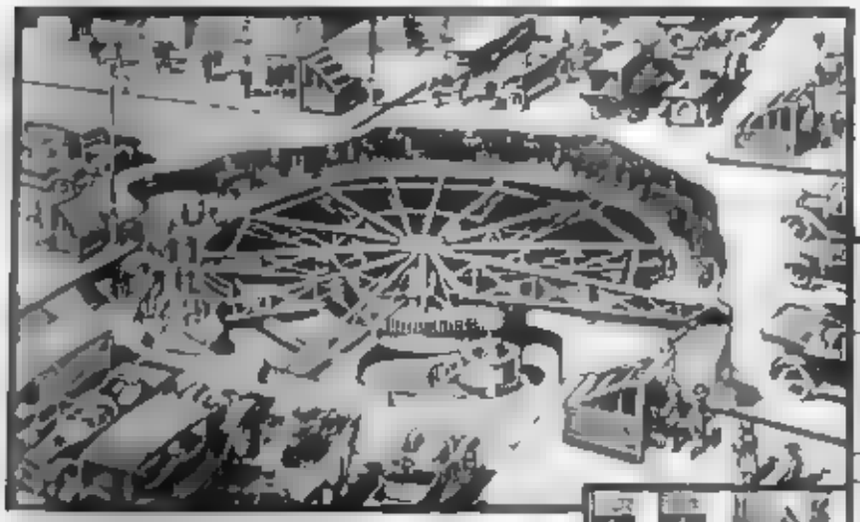
**By EDWIN F. LINDER, M. E.**

NOT so many years ago, when the country folks visited the city, they would stand at the curb of the sidewalk and patiently wait for a chance to cross to the other side of the street. The city people would glance at the confused expressions on the faces of these country cousins and dart in and out among the cabs, trucks and horse-cars and leave the astonished visitors to wonder how so many reckless persons were able to run across the streets at will, without being trampled under hoof or ground to death under the thousands of fast spinning wheels.

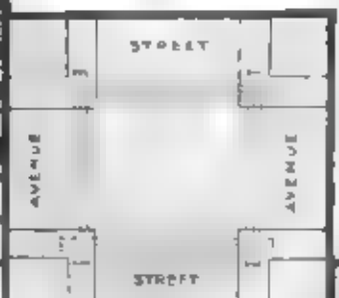
The ever-increasing number of automobiles operated in the large cities has necessitated the building of a police corps of traffic experts to regulate the movements of the pedestrians as well as that of the vehicles. Much valuable time is lost at present by the halting of one and then the other at centers of congestion. To aid in keeping the movements of the rolling mass and also the steady stream of those on foot more uniform, it is suggested that moving platforms, electrically operated, be installed to carry the pedestrians from one side of the street to the other.

One scheme is to have the entrances to these underground conveyors located at a distance of about thirty feet from the street corners, from whence an inclined moving platform carries the people below the street and across to another incline operating upward to an exit similarly situated on the opposite side. This type of conveyor would serve most efficiently by the construction of eight moving endless chain platforms, placed in pairs, each working in opposite directions. The four street corners are thus connected by these sub-surface passages and as the platforms are kept in motion continuously by the electric motors which drive them, it is obvious that there need be no delay in getting quickly to the other side of the crossing. At the same time, the discontinuance of the use of the ground level as a means of crossing by pedestrians gives a much freer scope to the movements of motor-driven conveyances. In some cases, for the better distribution of the people, it might be suitable to install a set of moving platforms in the center of the blocks either at right angles to the street or possibly sometimes diagonally, should the crossing be narrow and requiring greater length to accommodate the necessary inclines.

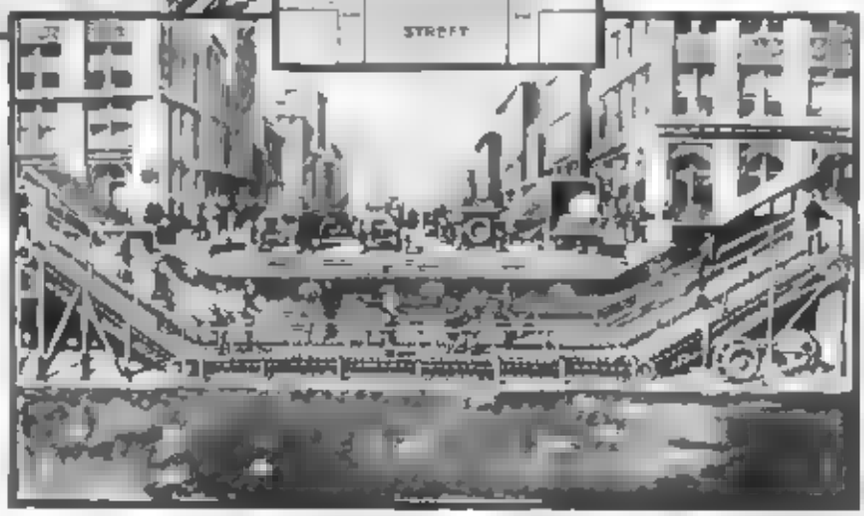
Another idea for the purpose of accomplishing the same end is the erection of an underground "Merry-go-round." A large circular platform rotates about a center post which is geared to the driving mechanism and connected to an electric motor. This rotary platform is reached from the sidewalks either by stairways or moving inclines such as described before. The outer edge of the platform travels close to the corner stations and thus the person using it steps aboard at once on reaching the lower level. Conspicuous signs electrically illuminated designate the *Avenue* and *Street* in the same manner as on the surface over [illegible] and as the rider [illegible] platform brings him to [illegible] At first may seem [illegible] to a great [illegible] trouble and expense to make insta[illegible]



Left, Why Not Use a Rotary Turntable For Street Cross Overs at Busy Traffic Centers in the Larger Cities, Like New York, Chicago or Philadelphia? Mr. Linder Tells All About It in the Accompanying Article




View Below This Illustrates a Second Idea For Moving Platforms Under Busy Street Cross Overs. Two Platforms Move In Opposite Direction One Between Every Two Corners. See Plan at Left



These sub-surface passages and platforms would be unnecessary if the overhead bridges were used, but the latter are unsightly and inconvenient, and are not used by the majority of people. Many will object to installations of this kind. Some may even think that ordinary passages built underneath the street surface reached by the usual stairways plenty good enough. Why all these electrically controlled mechanisms?

The answer is that the latter serve as the stern and strict regulators of the moving masses. In both schemes suggested the people are kept moving along in certain definite directions, being transported at all times safely and rapidly without delay to their proper destinations.



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Volume VIII.
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Science and Invention

H. GERNSBACK – EDITOR
H.W. SECOR – ASSOCIATE EDITOR

OCTOBER
1920
No. 6

# How Were the Pyramids Built?

THOSE of us who have been interested in, or studied the great pyramids of Egypt particularly that [illegible] of the subject having to do with the erection of these [illegible] wonderful to a worthy but [illegible] people [illegible] nonplust when it came to reasoning out just how the Egyptians raised the huge stones weighing many tons even tho they had tens of thousands of men available for the purpose.

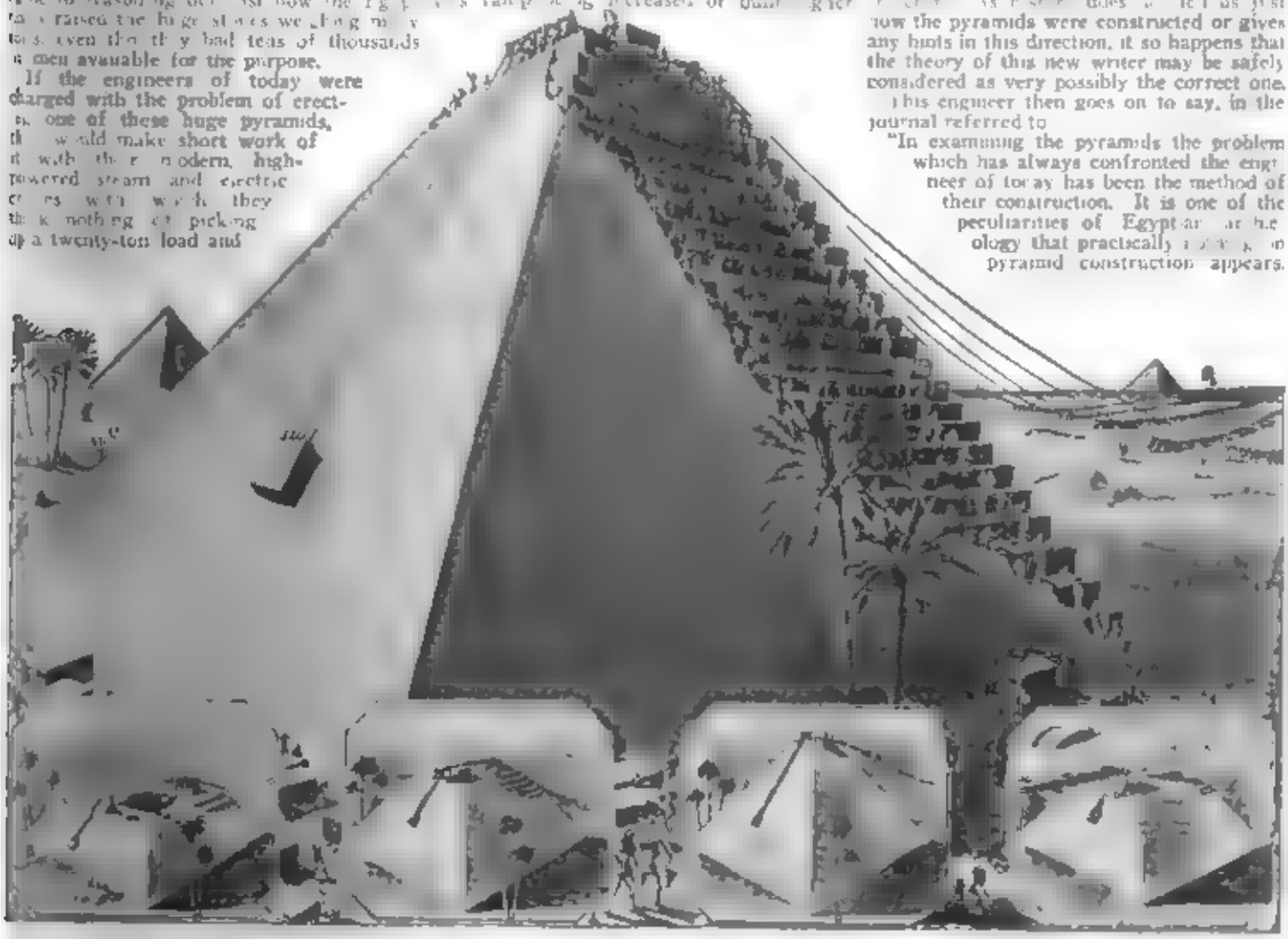
If the engineers of today were charged with the problem of erecting one of these huge pyramids, they would make short work of it with their modern, high-powered steam and electric cranes with which they think nothing of picking up a twenty-ton load and swinging it thru the air like a scuttle of coal at the end of a one hundred-foot steel boom. But history teaches us that the Egyptians had no such facilities as those possessed by our modern cranes, and even granting that they possess the ingenuity to build cranes, there were no gasoline or steam engines to operate them. And so the problem of how the pyramids were built, as usual, hammered down to the point where we can [illegible] and ten thousand men pulling on each rope, [illegible] way or ramp built of earth, the pitch of [illegible] increases or built higher as the work proceeded.

Altho this is one of the principal methods suggested by students of the subject of how the pyramids were built, a startling new theory, which seems to have considerable essence of logic in it, has been brought forward by a present-day engineer who writes on the subject in the *Indian and Eastern Engineering*, of Calcutta, India. In a few words, the theory of this engineer is that the [illegible] which still remains on [illegible] of ornamentation, namely, that of acting as [illegible] which [illegible] stone blocks were pulled by ropes past over a series of rollers at the top of the [illegible]. As to how this was just how the pyramids were constructed or gives any hints in this direction, it so happens that the theory of this new writer may be safely considered as very possibly the correct one.

This engineer then goes on to say, in the journal referred to:

"In examining the pyramids the problem which has always confronted the engineer of today has been the method of their construction. It is one of the peculiarities of Egyptian archeology that practically [illegible] in pyramid construction appears. Thus no evidence of any kind has been unearthed to show that they had that profound knowledge of mechanics which would enable the construction and operation of cranes sufficiently large and powerful to swing blocks of stone weighing several tons and place them in position anywhere up to nearly 500 feet in the air. The absence of such proof is only negative, but, on

(*Continued on page 665*)



A Theories by a Present Day Engineer That the Great Pyramids of Egypt Were Built in the Manner Illustrated—the Gigantic Stones Having Been Pulled Up the Smooth Surface of the Pyramid, Which Surface Finish of Cement Is to be Seen to This Day on Some of the Pyramids. The Older Idea Involved the Construction of Large Earthen Ramps, Which Had Afterward to be Destroyed.



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# A "Propeller-less" Airplane

## By H. WINFIELD SECOR

SINCE the invention of the first airplane, practically every inventor who has evolved new principles for the propulsion thru the air, of a heavier-than-air type of machine, has invariably advocated the employment of some form of air screw or propeller. Every airplane today, used in the armies and navies of the world, uses a propeller rotated at high speed by powerful engines, developing several hundred horsepower.

Wherefore and hence we have with us at present the very latest idea in airplanes, not only for small machines, but for large ones which may eventually be used for transatlantic and transcontinental air travel—*the propeller-less airplane!* One of the main features of the new blower-type airplane, here shown and designed by one J. W. Webb, of Chicago, is the fact that the machine can be elevated vertically from a given spot and does not require an elaborate landing and starting ground of considerable size as at present.

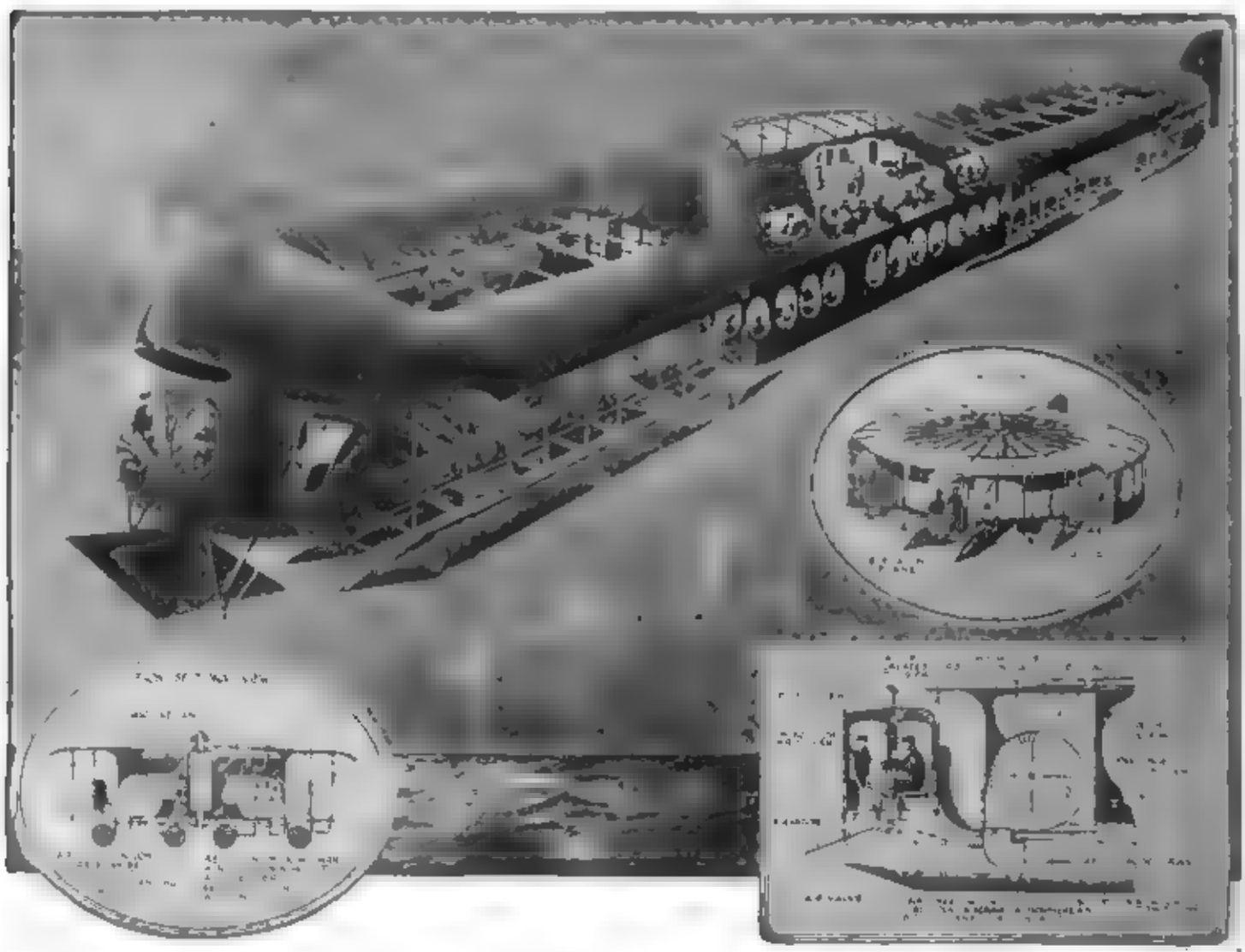
Among the other features claimed for this machine (which employs the resulting effects due to sucking downward a powerful draft of air thru the openings in the top of the machine, and blowing the air out by means of powerful engine-driven blowers from under the wings) are the following: That the machine will be able to sustain a considerable load and ascend vertically to any desired height; maneuver laterally at any desired angle with or against the wind; and, moreover, it is capable of hovering in a stationary or fixt position in any desired point, ascending or descending as may be necessary to avoid air currents or to take advantage of them.

Such a stationary flying craft would be of untold advantage in military maneuvers when used as a wireless station for directing artillery fire, and for numerous other purposes in both peace and wartime.

The inventor of this new propeller-less airplane makes use of several aircraft engines such as the *Liberty*, or other type of gasoline motor, which are directly connected to a series of powerful air *blowers*, enclosed in the usual steel housings, these fans sucking the air downward thru the top of the plane and whirling it around until it attains a high velocity, and then shooting it out thru the funnels, as shown by the arrows in the drawings. The reaction of these multiple blasts of air against the atmosphere causes the plane to rise.

The plane is also caused to rise due to the partial vacuum produced above it when the blowers are started, owing to the powerful suction present. The airplane is directed or steered in any desired direction by deflecting a certain number of blower air streams by means of suitable dampers or valves down thru a series of curved nozzles placed under the floor of the machine. The powerful drafts of air shot out horizontally thru these nozzles react on the atmosphere, causing the plane to move in the opposite direction, as the arrows clearly show. Suitable elevating and rudder planes are provided fore and aft also to help navigate the craft.

This airplane may be fitted with collapsible wheels for use when descending upon land also with pontoons for landing on water. The inventor provides a clever system of inflatable pontoons which are quickly filled with air from a motor-driven air blower. These may be covered with rubber cloth or *doped* airplane fabric and not only may serve as soft cushions in landing the machine, or pontoons for water descents, but also serve as *keels* which assist in maintaining the machine in a true course while flying. The air dampers or valves as well as the elevating and starting rudders are all controlled from the pilot's cabin at the front of the machine. For a circular airplane of this type, 32 feet in diameter, the inventor proposes to use a 400 H.P. engine, driving eight fans or blowers with a capacity sufficient to draw a total of 280,000 cubic feet of air per minute at a velocity of 55 miles per hour.



"Propeller-less" Airplane Devised by Chicago Inventor Which Employs the Usual Engines But Instead of Driving Propellers, They Serve to Rotate High Speed Blowers Which Develop Powerful Drafts of Air. These Rapidly Moving Air Currents Are Deflected Out and Downward from Under the Wing Surface, for Vertical Ascension—and Horizontally, Thru Curved Nozzles, for Lateral Propulsion in Any Direction. The Vacuum Produced at the Top of the Machine Aids in Ascending Vertically from a Given Point.

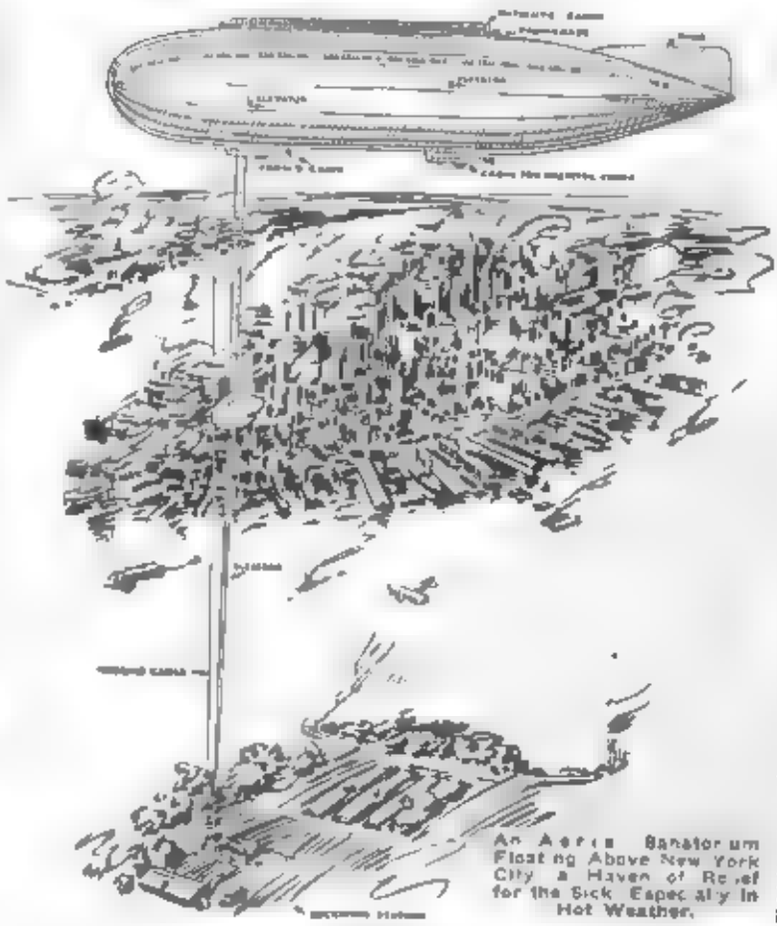
# An Aerial Sanatorium

**By F. E. LOUDY, AE. E.**

TWO things are essential in this world-wide battle against the white plague: sunshine and fresh air. Usually this means a costly trip to Colorado or some other high and dry territory. Instead of transporting tuberculosis patients to the sanatorium we should bring the sanatorium to the patients. This could be done by using giant captive balloons, structurally similar to the great Zeppelins, which can be moored near the large centers of population, like New York and Chicago, where this disease is most prevalent.

These giant airships would be composed of a rigid yet light duralumin structure, containing eight inflated cells of helium gas. Helium is an inert gas non-combustible and while lifting less than hydrogen is quite light enough for good efficiency.

The patients' cabin is located on top of the airship so as to get as much sunshine as possible, while the airship crew occupies the lower forward cabin and the hospital staff occupies the lower rear cabin. The ship is [illegible] feet in diameter, it becomes necessary to travel from cabin to cabin by means of an elevator operated by an electric hoist, as shown in the illustration.



An Aerial Sanatorium Floating Above New York City, a Haven of Relief for the Sick, Especially in Hot Weather.

The patients' cabin contains the sleeping quarters, dining-room, galley, library, dispensary, a piano and moving picture outfit. Everything possible is supplied to permit the patients to forget their ills.

The mooring cable, which anchors the airship to the ground, carries with it telephone and electric wires, which means electric illumination and constant telephonic communication.

Food supplies as well as people are conveyed to and from the airship by means of an electric hoist in the forward car or cabin. Patients who cannot stand the elevator trip up to the airship can be carried up by an airplane ambulance in the manner here portrayed, the airplane landing on or hopping off from the giant upper deck easily.

The airship is usually held between 5,000 and 10,000 feet altitude. Here the air is pure and invigorating, and usually cool. There is a promenade around the outside of the patients' cabin where they may sit or walk. Here, everything is restful and quiet. Rain clouds usually form around 5,000 feet, so when they appear the airship is allowed to go above them.

December 25 cents

# Science and Invention

FORMERLY

## ELECTRICAL EXPERIMENTER

'ATER CURTAIN
OTECTS FIREMEN
See Page 850

Volume VIII.
Whole No. 92

Science and Invention

H. GERNSBACK, EDITOR
H. W. SECOR, ASSOCIATE EDITOR

DECEMBER
1920
No. 8

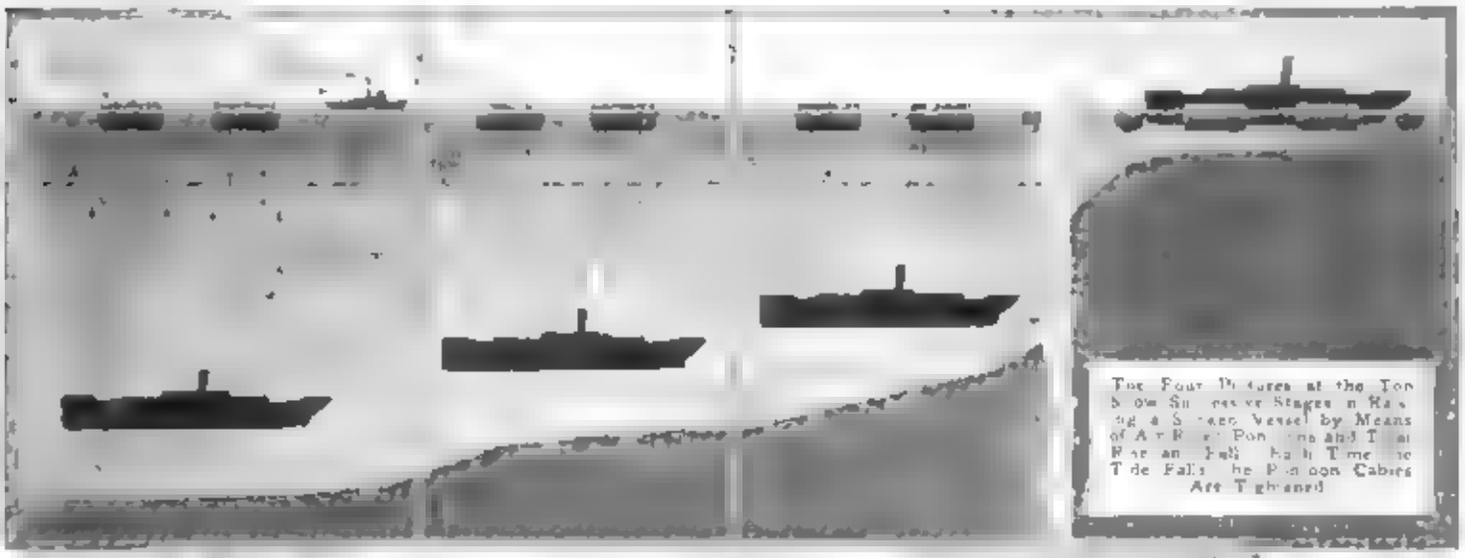
# Floating Sunken Ships

## How Submerged Electric Pumps, Comprest Air and Huge Pontoons are Raising Sunken Ships

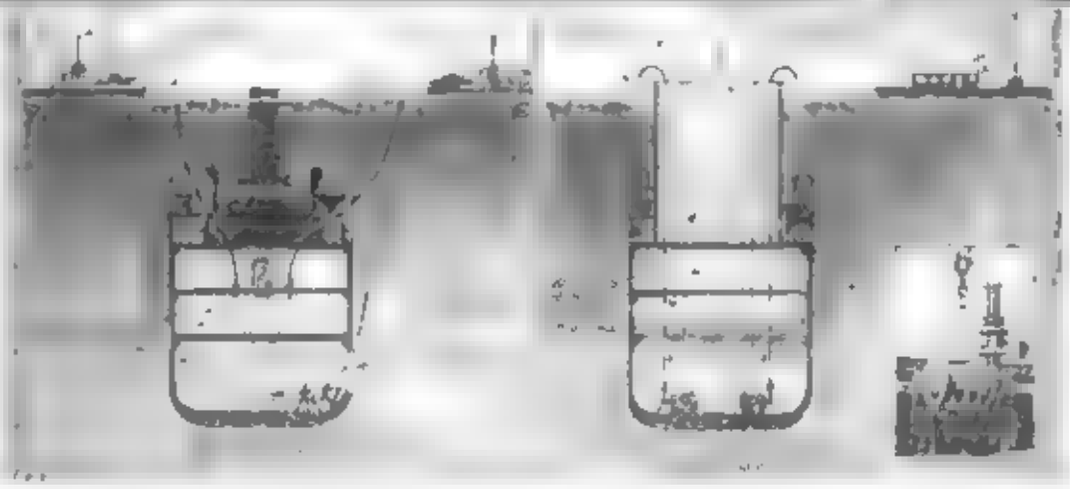
NOT only were hundreds of ships sunk by torpedo attacks and shell fire during the progress of the World War but there are many other wrecks which have lain on the bottom of the sea for years, some of which contain considerable wealth in the form of bullion and coin

is shot down thru tubes of steel and rubber into the bowels of the sunken ship—the deck hatches and other openings having been previously closed and tightened down thoroly by divers.

The first sunken wreck to be raised by this method of comprest air, was the *S. S. Royal George*. By the aid of divers and



The Four Pictures at the Top Show Successive Stages in Raising a Steamer Vessel by Means of Air Filled Pontoons and Tidal Power, Half Each Time the Tide Falls, the Pontoon Cables Are Tightened



The Scheme for Salvaging Ships by Means of Compressed Air Shown at the Right Has Been Successfully Carried Out by the Corps of Engineers, U. S. Army, in Raising Many Vessels Which Were Sunk in the Delaware River During the War. Other Ships Which Were Sunk in the Path of Channels Being Dredged Have Been Successfully Raised by Means of Compressed Air

In the Successfully Tried Scheme Shown at the Left Coffer Dams Are Built Directly Over the Large Hatchways in the Ship's Deck. Submerged Electric Pumps Are Lowered Into the Hold of the Vessel and the Water Is Pumped Out. Pontoons Are Then Placed Between the Coffer Dams and the Ship's Body and Securely Fastened. Before Any Repairs Are Undertaken, the Ship Is Made Absolutely Watertight by Means of Patches or Otherwise Taken Care Of

Salvage experts, the world over, have become awakened to the fact that a fortune awaits those who will conceive successful schemes for salvaging the hundreds of vessels which were sunk in various European waters, not to mention many dozens of ships which were sunk off the American coast from time to time, either by accident or otherwise.

The accompanying illustration shows three very interesting and practical inventions which have been successfully applied in a number of instances for the salvaging of sunken ships. These include three striking and logical applications of the "laws of Nature" plus mechanics, comprest air and electricity

### Floating Ships by Comprest Air.

One of the most spectacular and surprising methods of floating submerged ship hulls, particularly to the layman, is that involving the use of comprest air to render buoyant all or the major portion of the vessel's hull

One of the accompanying illustrations shows how comprest air applied from powerful compressors, driven by steam or gasoline engines carried by the salvage craft, experts in this class of work, the decks were suitably strengthened and all hatchways and other openings closed. Suitable air locks were installed as shown in the illustration to enable the *sand hogs* (that is, men who are accustomed to working in a comprest air atmosphere), to gain entrance to the lower holds of the vessel.

In many cases, including the present one, the outside rents are covered as accurately as possible with large flexible blankets braced by steel and wooden beams, known as patches. The comprest air when shot down into the lower hold compartments of

(*Continued on page 929.*)

January

25 cents

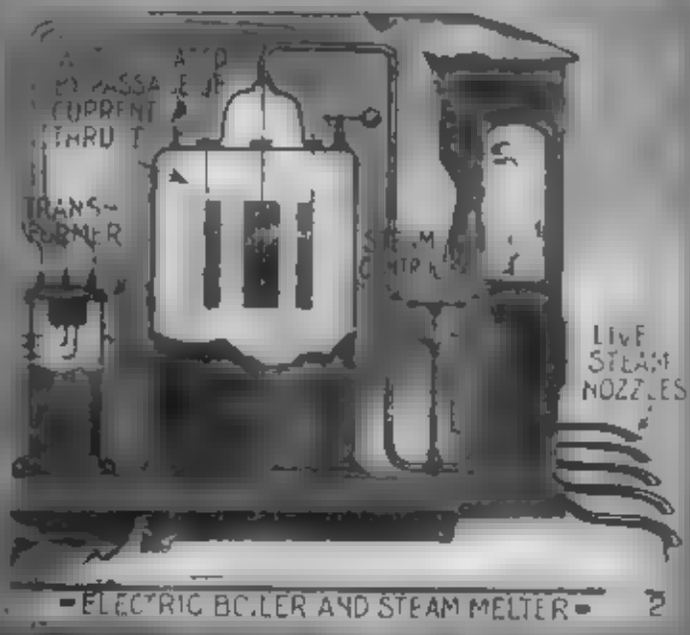
# Science and Invention

FORMERLY

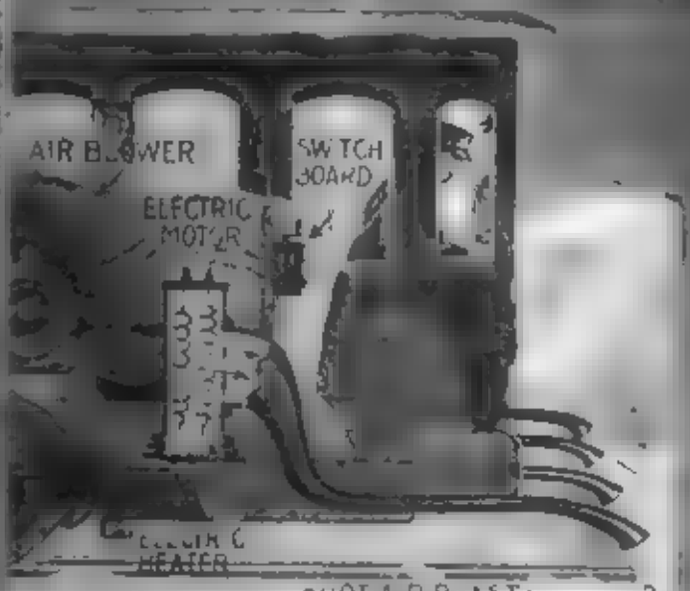
ELECTRICAL EXPERIMENTER

# SNOW AND ICE MELTERS

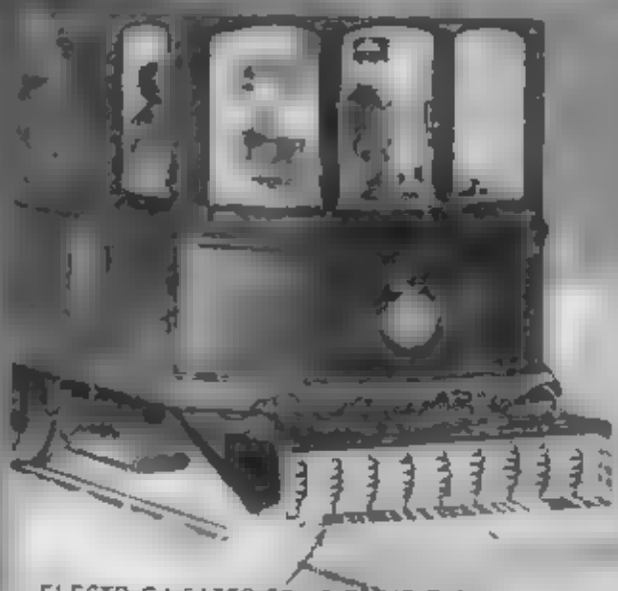
1



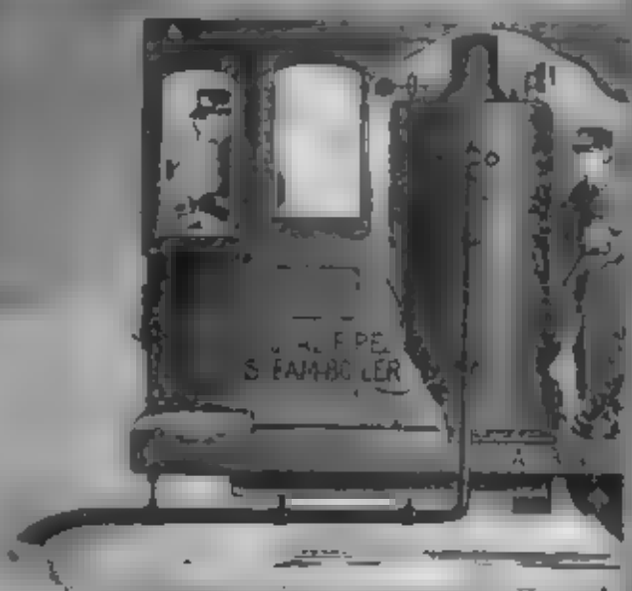

=ELECTRIC BOILER AND STEAM MELTER= 2



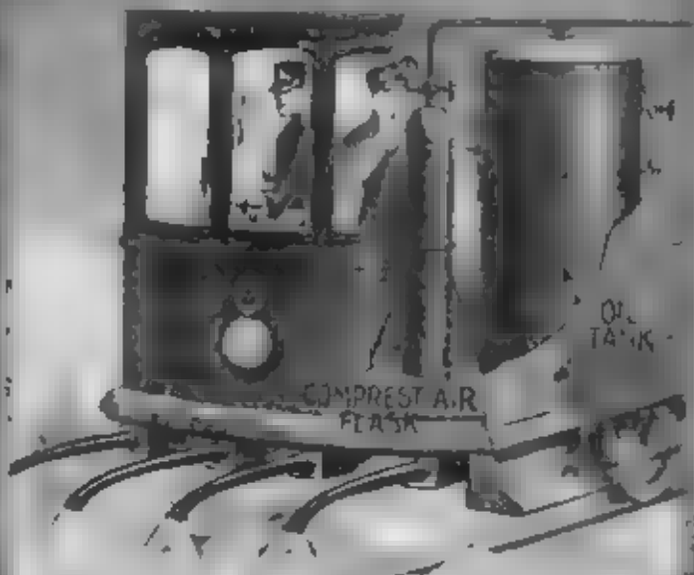

=HOT AIR BLAST= 3



=ELECTRIC HEATED COILS TO MELT SNOW= 4



=LIVE STEAM MELTS SNOW= 5




=LIQUID FLAME THROWERS MOUNTED ON CAR= 6

June

25 cents

# Science and Invention

FORMERLY

ELECTRICAL EXPERIMENTER

MUSIC !!
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See Page 130

Volume IX
Whole No 98

Science and Invention

H GERNSBACK,- EDITOR
H. WINFIELD SECOR.-ASSOCIATE EDITOR
T.O'CONOR SLOANE, Ph. D.-ASSOCIATE EDITOR

JUNE
1921
No. 2

# Rockets Filled With Powder and Oil to Ignite Airplanes

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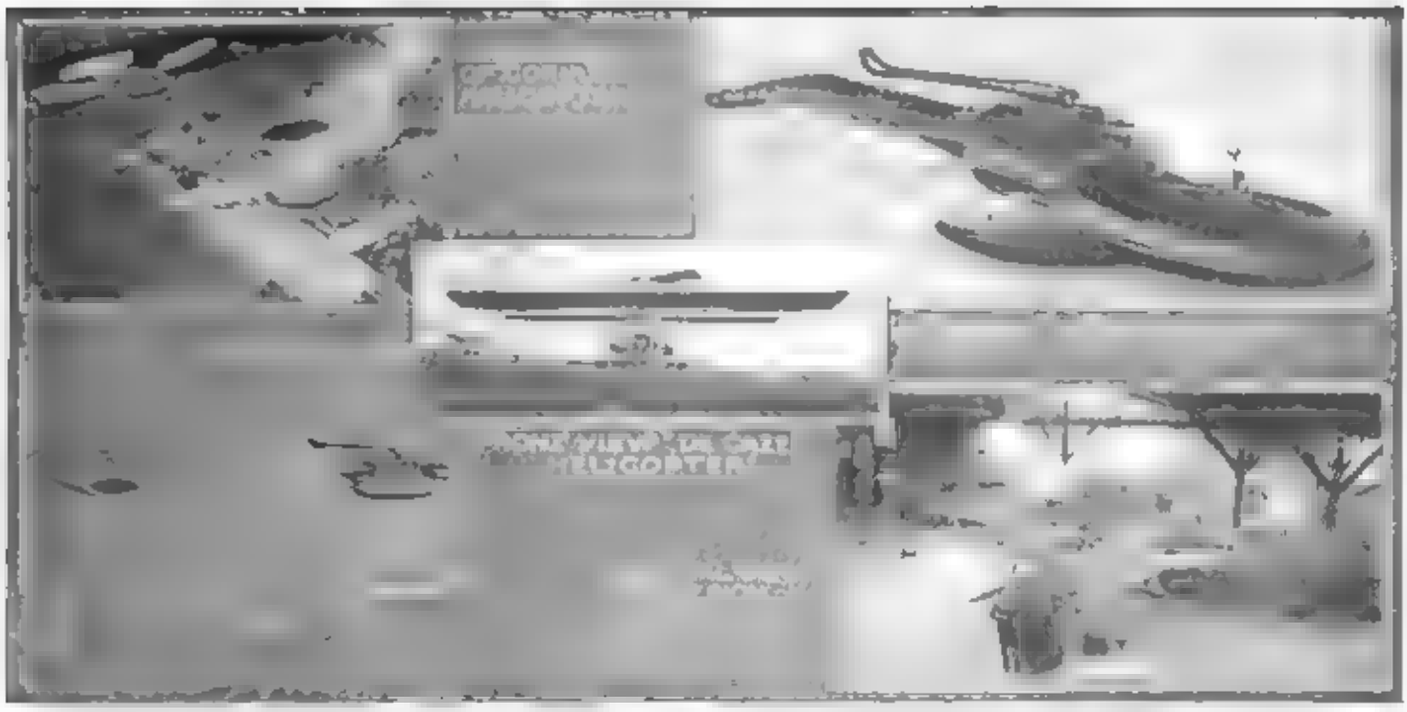
**The Illustration Above Shows an Airplane Battle of a Future War—the Aircraft Being Attacked by a New French Type of Rocket Filled with Explosives and Oil. These Rockets are Intended to Set Fire to Airplanes and Besides, They Will, upon Bursting, Hurl Pieces of Steel Shell Thru the Thin Walls of the Metal Cabins of the Planes. These Rockets May Moreover Contain Liquids for Creating Poisonous Gases in Large Volume. The Rockets are Fired from Special Guide-mounts Which Can be Placed on Auto Trucks, so as to be Readily Mobile, thus Rendering the Aviator's Chances of Bombing the Firing Device and Crew Very Uncertain.**

THE French military experts are said to be developing a number of extremely clever and powerful engines of war. Among other new war devices is a shell to be propelled by a series of explosions, each giving a fresh impetus to it, and calculated to keep the projectile in flight, rocket-fashion, for 100 miles or more

Another invention of far-reaching importance is a gigantic aerial bomb, which will exert such a terrific explosive effect when detonated, that bombing planes equipt with these bombs can destroy a whole city, army corps or fleet.

The present illustration shows one of the latest developments which is being worked out in France—a huge rocket filled with explosives and oil and intended to ignite or set fire to airplanes. These rockets can be constructed quite cheaply and are fired from a special guide or guide-mount as shown in the illustration. When the rockets reach the predetermined altitude, for which their time fuse has been set, the explosive within the rocket head, will blow it to pieces, when the highly volatile oil within the rocket will ignite and streams of fire will sear the sky, as hundreds of these bombs are fired on the approach of an airplane squadron These rockets are arranged so that they may contain liquids which will vaporize quickly and produce powerful poisonous gases, so that if the plane is of metal construction and cannot be ignited, the gas will make it very uncomfortable for the aviators, especially if some of the gases recently discovered are used, which act in such a manner as to cause those caught in them to rip their gas masks off

Of course, it would seem that the airplanes, attacked by such rockets, might attempt a counter attack, either with machine guns or else with aerial bombs dropt thru the air, but it would be difficult for the airmen to ascertain the exact locations from which the rockets had been fired and with the present highly developed and rapidly improving *camouflage*, and also by the utilization of moving gun or rocket mounts, carried for example on rapidly moving auto trucks, it would be almost impossible to locate a place for a bomb attack or to assail with machine-gun fire the men who had fired the rockets.



Several Interesting Types of French Helicopter Planes are Illustrated Above. The World War having Interfered Greatly With the Development of This Type of Flying Machine.

# Will the "Helicopter" Be the Flying Machine of the Future?


## By E. H. LEMONON

RECORDING SECRETARY OF THE FRENCH AERIAL ASSOCIATION


THE first suggestion of the Helicopter is found in the works of Leonardo da Vinci, where a design is described of an Helicopter formed by a "great screw turning about a vertical axis." Towards 1768, Paucton lays down the principle of a machine having "two turning mills, one to support the apparatus and one to drive it along."

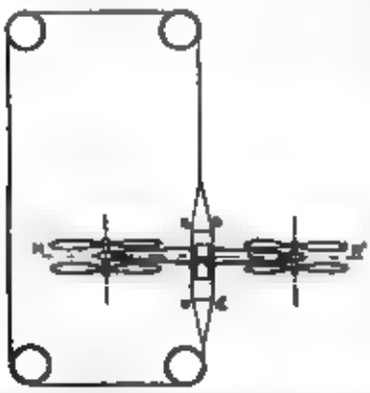


Fig. 1. Principle of the Dufaux Helicopter, Which Actually Flew. An Engine M Rotates Two Pairs of Horizontal Screws, H and H'. These Screws Turn Two-By-Two in the Same Direction, Each of the Two Lateral Pairs Turning in Opposite Directions.

In 1784, Launoy and Bienvenu built a machine consisting of a bow which was bent while making the string perform some revolutions round the arrow which bore at its free end a screw formed of four feathers. The lower part of the apparatus had another screw, and in flight the arrow and the upper screw turned in one direction and the lower group turned in the opposite direction.

During the 18th century there were many attempts in this direction, but none attended by any great success.

In 1862, Ponton d'Amécourt had an interesting machine built. The boiler was made of aluminum and the cylinders of bronze, and the pistons worked two screws 10.56 inches above the ground turning in opposite directions. Total weight 6 lbs., boiler 3¼ inches high and 4 inches diameter. Total height of model, 2 feet.

In 1877, Enrico Forlanini built a remarkable steam Helicopter, which for the first time left the ground bearing its own engine. The steam generator was a little hollow sphere filled two-thirds full of water previously heated to a pressure of 160 lbs to the sq. inch. The engine drove one supporting screw and the machine rose 5.2 inches and remained in the air 20 seconds.

In 1903, Colonel Renard, established by calculation the "possibility of sustaining in the air a flying machine of the Helicopter type, using internal combustion engines in their actual state of lightness."

In 1905, Dr. J. Richard flew the machine "Leger" for a few minutes. It had two co-axial screws superposed with a diameter of 210 inches, turning in opposite directions. Total weight, 187 lbs. An electric motor drove the screws and the accumulators which supplied the electric energy were on the ground, connected to the Helicopter by two conductors.

The brothers Dufaux were the first to produce an Helicopter rising by its own means carrying its engine and gasoline. In 1905 they built a machine, the model of which from the very first rose by its own means, carrying a useful load of 13 lbs. The engine M had two double-acting cylinders and air-cooled by small fins. It drove two pairs of horizontal screws H and H' each having a diameter of 80 inches, and placed at the ends of rigid bracing in tubes of steel a b c d. These screws turn two by two in the same direction, the two lateral pairs turning in opposite directions. They are made with great care with radii of hollow wood and covered with glazed silk. Total weight of Helicopter, 38 lbs. Normal speed of engine, 1 500 revolutions per minute, giving a little over 3 h. p.

Fig 6. Papa—Reuilly "Gyroplane." The Hollow Wing C-E-A, Has a Current of Air Sucked Thru It By the Engine B, the Air Escaping From the Tip H, the Reaction on the Surrounding Air Causes the Wing to Rotate and Lift the Apparatus Into Space.

In 1907 Breguet and Richet constructed their "Gyroplanes." The first weighed 1,364 lbs. and rose easily with its pilot nearly six feet above the earth. Area of wings (rotary), 280 sq. feet. Engine, 45 h. p. The second had screws giving a vertical thrust of 1,056 lbs., h. p. 37. The machine flew horizontally about 20 minutes.

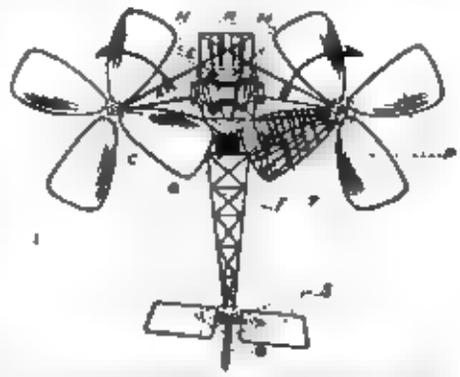


Fig. 7. The French "Alerion" Helicopter, Provided With "Revolving Wings." The Plane Has the Usual Fuselage, Rudder G, and Stabilizing Tail Plane, E.

Paul Cornu constructed an Helicopter the screws of which covered an area of 65 sq. feet, h. p. 12, bearing weight of 572 lbs. With two men on board the total weight is 721 lbs. The machine rose easily, its engine developing 15 h. p.

In 1912 Vicomte Decaze constructed a machine with two planes of 250 sq. feet each in tandem. There are two supporting screws superposed and co-axial 13⅓ feet in diameter turning in opposite directions, and driven by a "Gnome" engine of 50 h. p. To left and right two small planes stabilise the machine. Their efficiency is constant what-


(*Continued on page 182*)





Google

# Dynamite Boosts Plant and Tree Growth

## How Blasting the Soil Enables Roots to Gather Food and Water from Lower Soil Strata

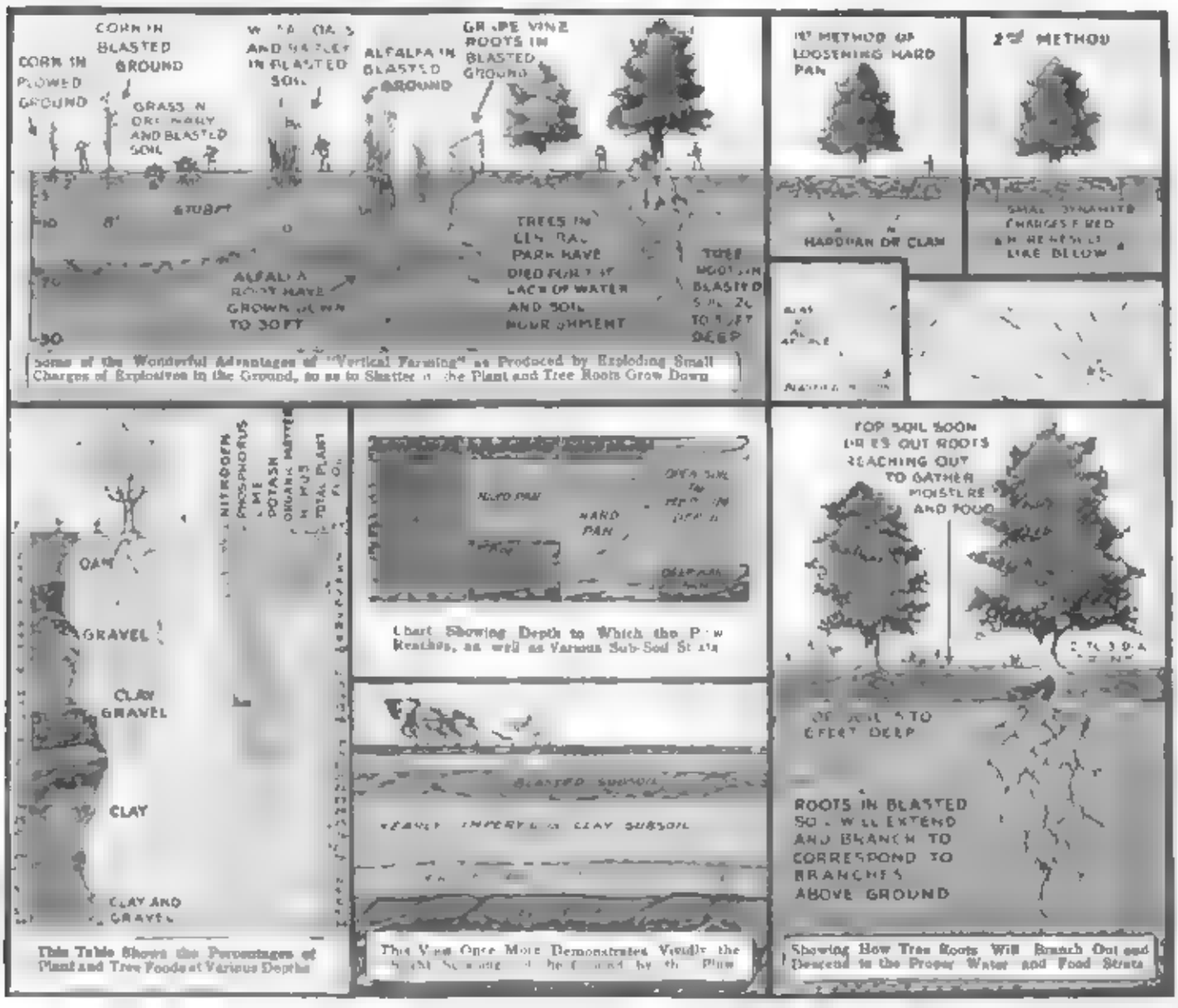
IT is admitted that present methods of cultivation do not penetrate sufficiently into the earth, and that the use of specially prepared agricultural explosives would seem to offer the desired remedy. It is admitted by all authorities in agriculture that the plow and harrow do not go deep enough and they advise the use of subsoilers. Scores of books explain how and why each piece of machinery turns over the soil, reduces it to fineness, forms mulches, saves water, breaks clods, aerates, stimulates bacteria, etc.

If all this wealth of invention and labor is worth while bestowing upon the first few inches of the soil, why is it not worth following the roots down to their second foot of growth, their third, and even their eighth and tenth foot when they flourish at those depths. The only reply is, "Yes, it would pay, but how can it be done?" It can be done economically, quickly, and thoroly by the use of explosives. Deep plowing is recommended by all authorities "wherever the resisting soil will permit." Machinery, made especially for deep work may be stopt by the hard sub-soil, but nothing can resist the explosives. The farmer plows, harrows, and spends a vast amount of time, labor and money in cultivating the surface foot and rejoices in the wonderful alchemy that follows his endeavors—the mysterious activities he has set in motion. He works cheerfully and with confidence, largely because he can see what he is doing. In the new agriculture he must work by faith and reason at depths where he cannot see with his eyes what is taking place. The result will place before his eyes, in the form of bumper crops, proofs of the benefits of his work. The new agriculture simply points out the benefits acquired by the thoro cultivation of the foot, or two feet, and by explaining how and why this is accomplished, points out the value of extending the cultivation further down by the simple means of explosives—all of which is pointed out by Prof. Gilbert Ellis Bailey, Dept. of Geology, in the University of Southern California, in his book entitled, "Vertical Farming."

The harrow warms and aerates the soil, and promotes activity by loosening and separating the soil particles at the surface. Explosives do the same, breaking, loosening, pulverizing at depths machinery cannot reach. Drainage is recommended by all, because it removes excess of water, admits air, and gives proper moisture conditions. Explosives have drained many a field and secured all these benefits at far less cost in time, labor and money than the usual methods of ditching and tiling involve.

The importance of nitrification is proven, but why confine it to the thin furrow slice, when the action of bacteria has been proven at depths of six feet in the humid soils of the East, and still deeper in the porous soils of the arid and semi-arid regions of the West? Why not loosen the soil and secure proper conditions by the use of some charges of explosives? It is admitted that there is much of plant food below the shallow plowed and cultivated ground, and that the roots will go down if they can. Why not open the way and make it easy for them by cracking and pulverizing the soil with explosives as far down as the roots care to go? It is admitted that water may be stored, as in dry farming, by converting the soil itself

(*Continued on page 162*)



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ANNUAL EXPERIMENTERS' NUMBER

August

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# Science and Invention

FORMERLY

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HOW TO BUILD BURIED TREASURE FINDER

See Page 335

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This Shows a Corner of the Famous "Hoo Hoo" House Which Visitors to the Panama Pacific Exposition Will Remember for Its Novelty, the Building Having Been Erected from Woods Taken from the Large Trees of California. The "Hoo Hoo" House Was Recently Purchased and Moved to a Location Near San José, California, and Has Been Converted into a Great Dancing Resort. By Means of Loud-Speaking Telephone Amplifiers, the Music of the Jazz Orchestra Is Distributed Over the Five Large Dancing Floors, Including the Veranda.

# One Orchestra for Five Dancing Floors

AT the Panama Pacific Exposition, there was an interesting building erected for the lumbermen of the country, called the "House of Hoo Hoo," after the name of the Lumbermen's organization. After the exposition closed, this building was moved in its entirety to a ranch in Santa Clara County, near San José, California. Here the Santa Clara Land Company re-erected it, waxed its floors, decorated it, and held dances there for the benefit of San José people, and the students of Stanford University, only a short distance away at Palo Alto.

A jazz orchestra, composed in its makeup of all-Stanford students, furnished the music and rapidly the *Hoo Hoo House* became known far and wide as a most popular dance floor.

It was soon found, however, that on Saturday evenings, when all five floors were crowded, there was not enough music to go around, and supply all the five floors. Mr Hensley, the enterprising manager, knowing of the existence of the new telephone loud-speakers, approached the makers of these instruments, and their engineers were sent

## How the Telephonic Loud-Speaker Solved the Problem

down to see what could be done in the way of spreading out the music of the available orchestra, so that there would be plenty for all on all five floors.

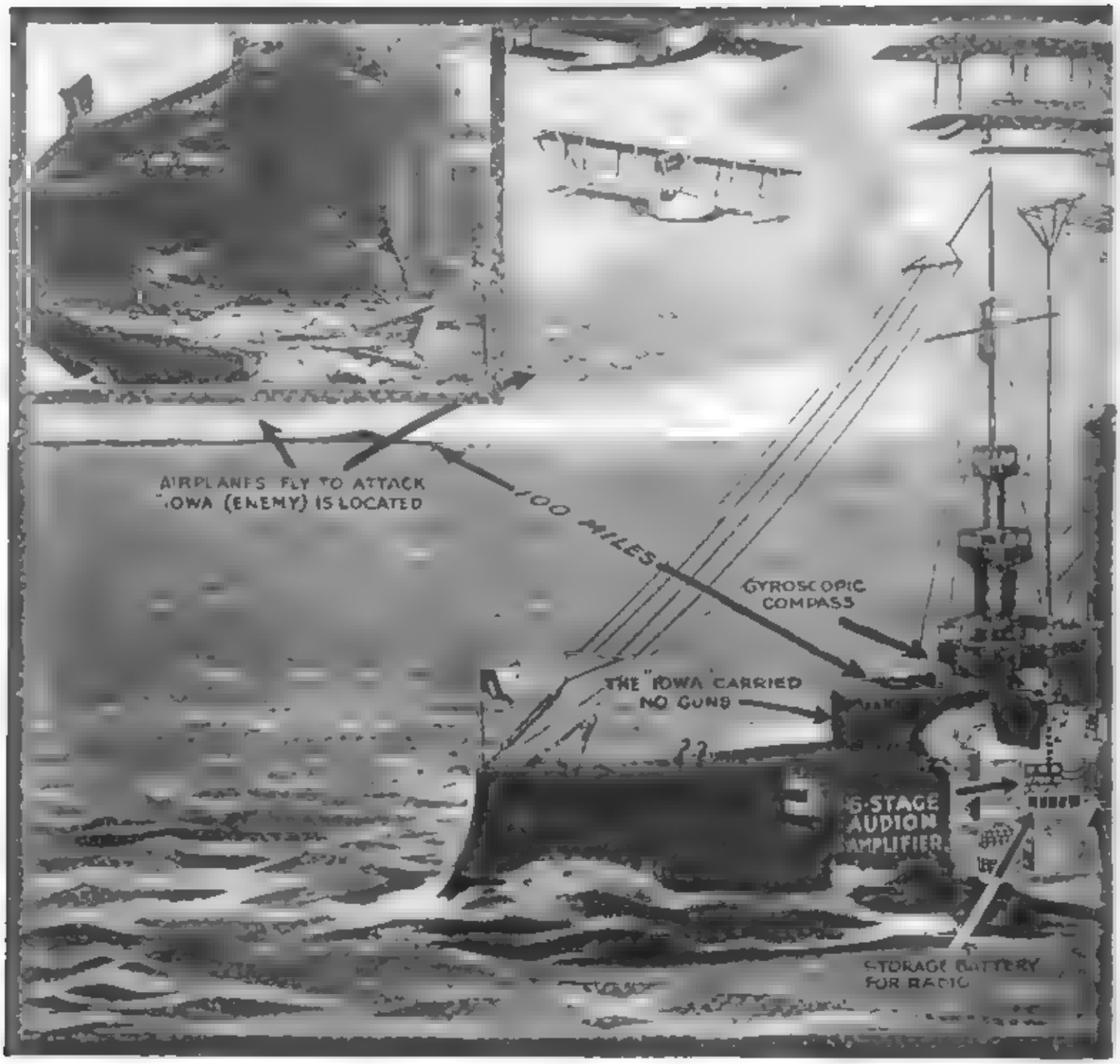
After a series of tests which were conducted while the dancing was going on, a large permanent installation was decided on, with all wiring fished thru the walls and installed exactly as would be the electric lights, as shown in circuit in figure 1. Six large telemegaphones were used in all, three on the inside and three covering the outside verandas, which has since been roofed over.

It was manifestly impossible to place five four button transmitters in parallel all leading into the same horn. Even were single button transmitters used, it would be found that to try and mix five different instruments through the same output horn, with series transmitter, would not give good results. Also it would not have been possible to give each instrument its proper tonal and volume value if the transmitters were in parallel, so an entirely different scheme was used.

The piano being the predominant instrument, carrying as it does most of the accompaniment, one four button transmitter was attached to the sounding board of the piano, leading thru its own induction coil to two horns, one inside and one out. This gave one of the group of three at each point entirely to piano music. The violin and trombone were placed in one circuit, and the saxophone and banjo on another circuit, in order that there might be as much difference as possible in the tonal quality of the instruments played thru the same transmitter circuit. This gave excellent separation — the violin could be separated from the trombone, and the banjo from the saxophone.

In summary then, we have three horns in two separate groups, one horn in each group playing the piano, one horn in each group playing the banjo

(*Continued on page 357*)




# Airplane or Battleship—Which?

## By GRASER SCHORNSTHEIMER

(ASSOCIATE MEMBER U. S. NAVAL INSTITUTE)

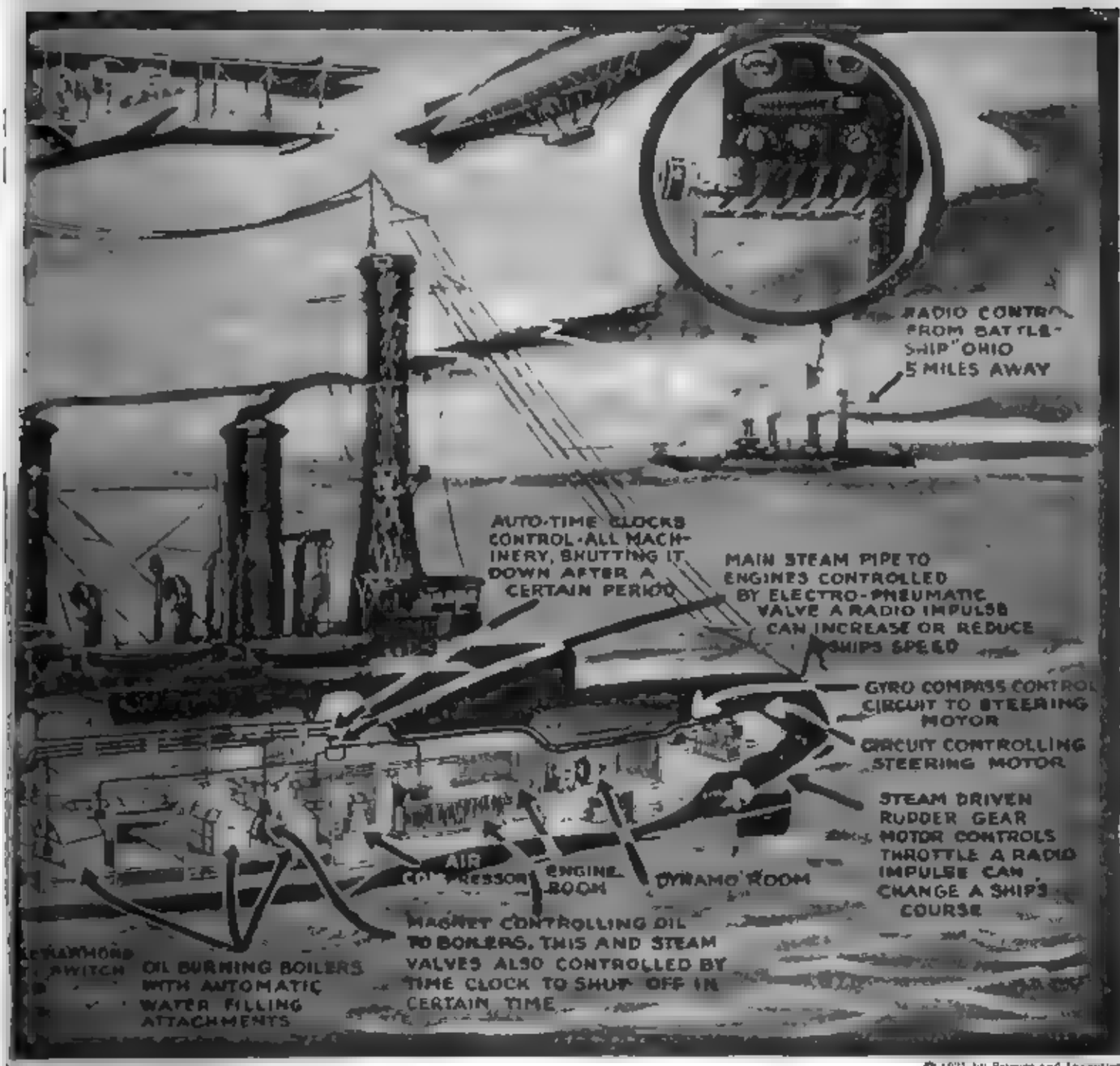
**The Fight Between the Airplane and Battleship—Tests Which Will Decide our Future Military and Naval Policies**

"IT isn't the shots you fire, but the shots that hit, that count." This is the reason why our wise and service seasoned Secretary of the Navy ordered that the bombing of the old battleship "Iowa," with dummy bombs, to ascertain the probabilities of hits, be conducted from an altitude of at least 4,000 feet. It is a wise and carefully thought-out order, for it is claimed, and to a great extent it has been proved, that an airplane can be driven off by anti-aircraft fire while at a height of no less than 6,000 feet.

Of course, this is based on naval anti-aircraft fire. The naval anti-aircraft battery usually consists of four, 3 inch, 50 caliber, anti-aircraft guns on high-angle mounts. With an efficient gun crew for each gun, and gun pointers who can shoot birds on the wing, such a battery can drive off any attack of bombing planes flying at an altitude of 4,500 feet or less. Of course, there are some who will want to contradict this; and their contradiction can only come thru the actual facts in the case. Never has an air attack on a battleship been successful, altho it has been tried many times.

An officer who was abroad with one of our battleships operating with the British Grand Fleet, during the latter part of the war, and who was in command of his ship's anti-aircraft battery, tells me that a German bombing attack was easily driven off, before it reached an altitude of 8,000 feet above our vessels. The Germans were always the premier bombers. What they bombed they usually "got." Everyone knows that. Then again, the Allies forced the Turks to ground their battle-cruiser, "Sultan Selim," formerly the German cruiser "Goeben," at the Dardenelles, during a naval action British, French, Italian and Greek planes in great numbers bombed her for hours *without results*. The Turks were able to get her off and back to Constantinople, and since she has been surrendered, it has been found that, if she was ever hit, there are no marks or ill effects of it. The reason is plain the anti-aircraft fire of the Turks was so good that the Allies could not get within accurate bombing range.

In theory the workings of anti-aircraft range-finding and fire-control are about the slowest and worst systems ever conceived by a human brain. They are difficult,

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**The Sectional View of the Radio Controlled Battleship "Iowa" Shown Above Will Give a Clear Idea as to How Radio Impulses Were Transmitted from the Battleship "Ohio" Five Miles or More Away. Special Radio Receiving Apparatus With Powerful Audion Amplifiers and Harmonic Selective Relays, Served to Control the Amount of Oil Passing into the Burners Under the Steam Boilers and the Direction Taken by the Ship Was Changed by Altering the Position of the Rudder by Radio. Time Clocks Were Connected With the Main Electro-Pneumatic Valve Relays, so That After a Certain Time the Steam to the Engines Would Be Shut Off as Well as the Oil Supply to the Boilers, if for Any Reason the Radio Control System Failed to Operate Properly. A Steady Course Could Be Maintained by the "Iowa" by Virtue of the Master Gyroscopic Compass, and Control of the Ship Taken Away From This Compass at Any Time by Transmitting Certain Radio Impulses From the "Ohio." Inset Photo on Page 308 Shows Effect of Bomb on the "Indiana." U. S. Navy Photo.**

puzzling and entirely unreliable. The plane can change its speed, elevation and direction practically at will. For this reason, in the opinion of the writer, anti-aircraft gunnery can never be set to rule. It will always have to follow the 'rules' of wing shooting. But these are no reasons why it should not be effective.

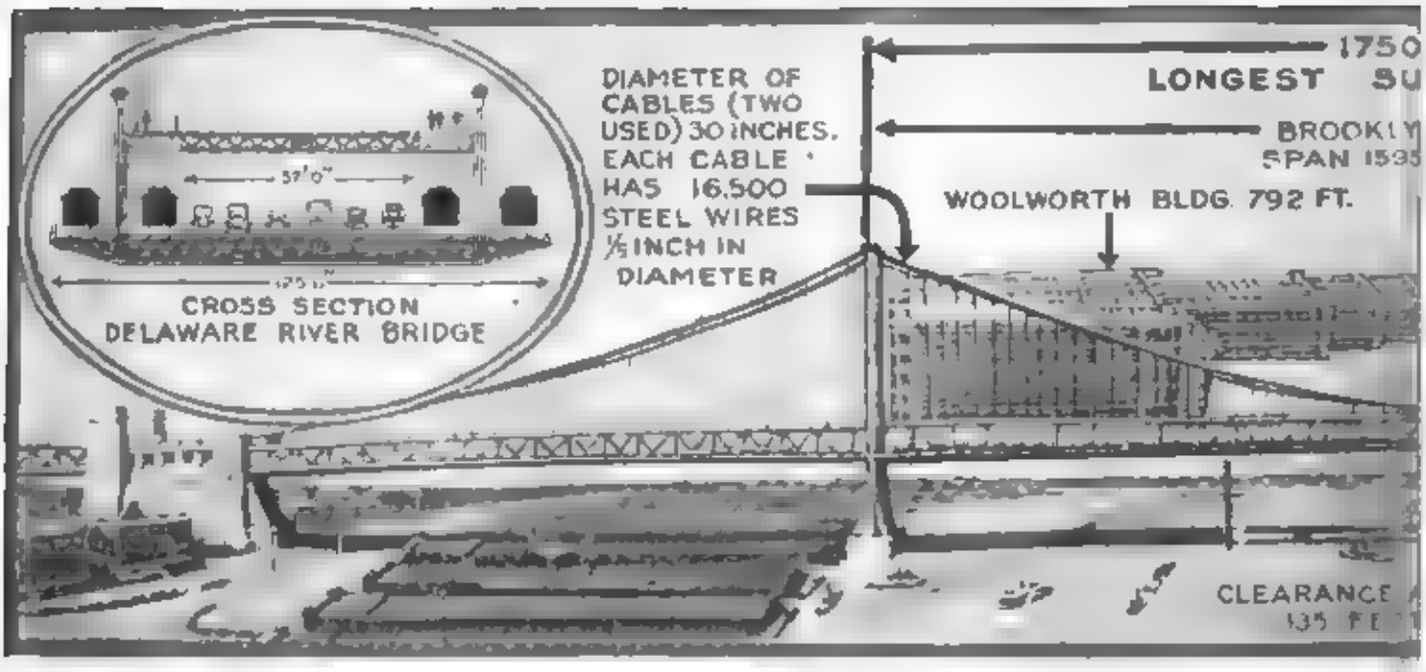
On the other hand the aircraft enthusiasts claim, that they can destroy any warship, and the crew in almost no time at all, with their explosive and gas bombs. They could but for one 'if'. If they could be allowed to drop their bombs from an altitude, low enough to insure a hit. A short time ago the Navy performed an experiment with the old battleship "Indiana." At high altitudes the planes could not hit, even tho they were undisturbed by anti aircraft fire. At very low altitudes at which the planes dropping the bombs could not have existed in a real action because of anti-aircraft fire, they destroyed the ship.

It is just this, that must be decided by these tests. The British were the first to fear the entrance of the plane into active naval operations, but now they put their money and confidence in four new battleships to cost over $50,000,000 each. The Japanese were badly buffeted by the same idea—that the airplane was infallible—now they are building the largest and most powerful capital ships ever known to man. The French were quite upset by it. Now they intend to build capital ships. Here are some results. While the United States is the last to be struck by the idea, she has probably been more profoundly impressed with it than has any other nation.

Spotting and scouting are the primary uses of the naval plane, the bombing planes meriting little consideration, because of their inability to hit their targets from reasonable altitudes. However it has been unquestionably proven, that aviation governs the naval situation to a great extent today. It would be the worst kind of folly for a fleet to go into action with an enemy, without first securing the control of the air. It has been said that with airplanes for spotting purposes, the gunnery efficiency of a ship is increased as much as thirty per cent. The ability of a ship to hit is the sum and total of the ship's efficiency. The ability of a number of ships to hit is a fleet's efficiency. The efficiency of the fleets is the Navy's competence and, upon the ability of the Navy to defend, lies the nation's safety.

Because of the failure of the bombing plane in naval aviation, another type, designed with the same general intent, came into existence. This type is the torpedo plane. The British have taken all bombing planes from their aircraft carriers and replaced them with Sopwith, "Cuckoo" type, torpedo-planes. However, the difficulty with the torpedo-plane is with the torpedo. During the war the torpedo so disappointed the Germans, as to ruin their

(*Continued on page 379*)




# World's Longest Suspension Bridge

**By DOUGLAS C. MINER**

THE longest suspension bridge in the world will be constructed across the Delaware River connecting the cities of Philadelphia, Pa., and Camden, N. J. After several years of discussion, legislation and preparation, work is about to start. Five years will be needed to build this bridge. A two-cable suspension bridge with a 1750-foot span, and clearance of 135 feet, to cost $28,871,000, has been recommended by the engineers appointed by the Joint Commission of the two states and of the city of Philadelphia, which three places will divide the expense.

As an engineering feat the bridge will have no equal. Three of the nation's foremost construction engineers have laid the groundwork for this project. Ralph Modjeski, world's famous bridge builder of Chicago; George S. Webster, former Director of Wharves, Docks and Ferries, of Philadelphia, and Lawrence A. Ball. Paul P. Cret is the architect, and Leon S. Moisseiff, consulting designing engineer.

Summarized briefly, these are the main

## Philadelphia and Camden to be Joined by Bridge Spanning Delaware River

facts or suggestions in the report of the engineers:

"That the structure cross the Delaware River with a single span 1,750 feet long center to center of main piers providing an unobstructed opening for navigation between pier-head lines.

"That the overhead clearance above mean high water be 135 feet over a width of 800 feet in the center of the span.

"That by reason of greater economy and greater ease and safety of erection and shorter time required for construction as compared with the cantilever type of bridge, the main structure be of a two-cable suspension type.

"That the bridge and approaches be built to provide a single deck carrying an unobstructed roadway for six lines of vehicles, also two lines for surface cars and two lines for rapid transit, and that two ten-foot sidewalks be provided above the roadway.

"That the foundation caissons of the main piers be sunk to bed rock, which is within practicable depth at the recommended locations."

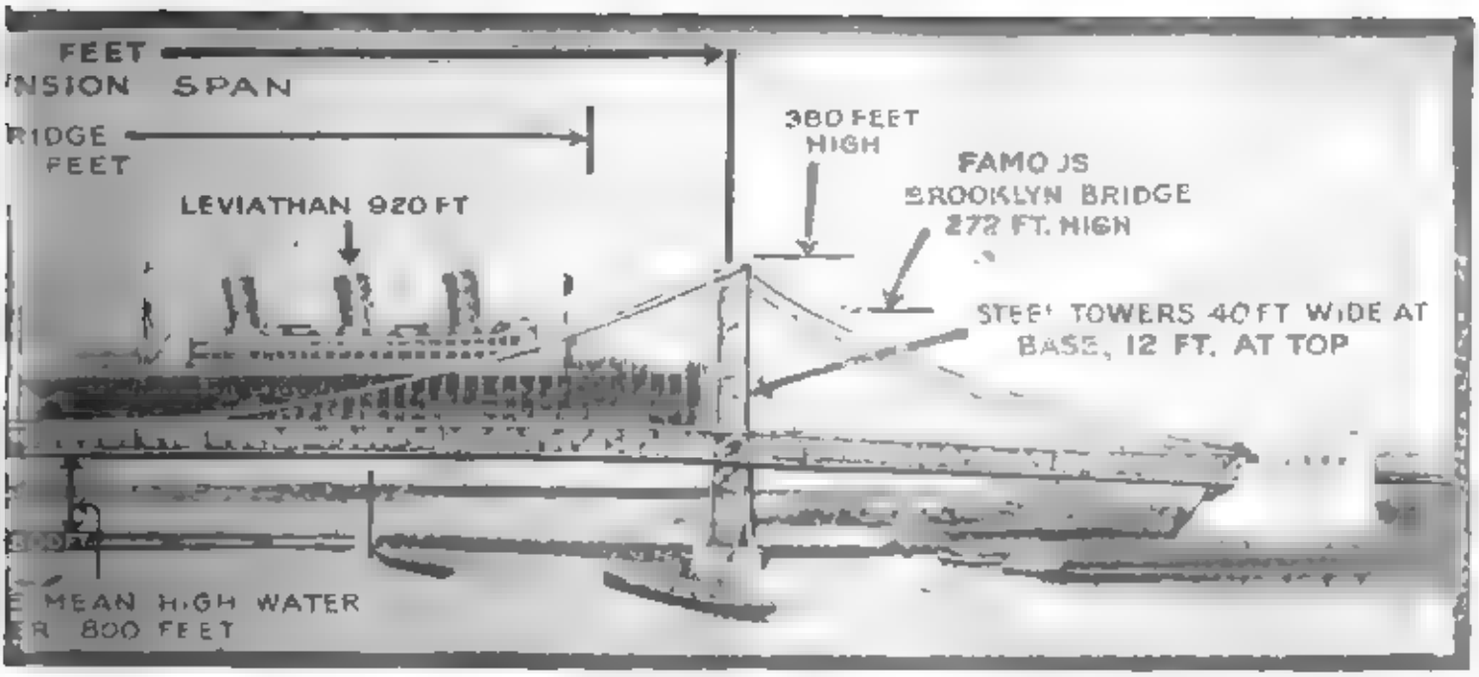
The estimated cost of the bridge and approaches, including land damages, is to be divided as follows: State of Pennsylvania, $8,721,000; State of New Jersey, $12,429,000; City of Philadelphia, $8,221,000.

Since the organized cooperation between the two states set the machinery in action last autumn for first actual work on bridge plans, only one disturbing factor has entered into the situation. That has been the choice of site. The fight over site, of course, has its purely local angles, and devolved into a dispute between business interests in various sections of the city. The engineers in their report, submitted on June 10, recom-

# An Amphibious Boat

We illustrate a cargo boat for use on the Congo River in Africa. It is the invention of M. B. Goldschmidt, a Belgian millionaire engineer. The Congo River has many shoal places and when the boat comes to these, it is transferred to a mono-rail and travels rapidly along, still actuated by its own engine. This does away with the annoying portages incident to travel on the great African artery. In the Congo Region the river is everything, as the absence of railroads makes water transit the best of all modes of conducting traffic in that land of endless forests and few roads. The motors are to be fed with palm oil, a fuel which in Africa costs very little, and has a high calorific value. The boat will have power enough to pull two or three other boats of the same size, so that it can take quite a tonnage up the river into the heart of the Dark Country. It is interesting to think that the country can supply vegetable oil for fuel for internal combustion engines. One of the last ideas of Arctic explorers is to call upon the open ocean for their fuel and to drive their motor with whale oil. The photograph was taken upon a Belgian Canal on the occasion of its first trial trip.

A Boat for Use on the Congo River to Be Propelled by Palm Oil for Fuel and to Surmount the Shallow Places on a Mono-Rail Road.

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**Work Is Soon to Be Started on the World's Longest Suspension Bridge Which Will Span the Delaware River Between Philadelphia and Camden. The Central Span of This Bridge Will Measure 1750 Feet in Length and the Largest Vessels Can Easily Pass Under It. This Gigantic Bridge, Altho a Great Deal Larger Than the Famous Brooklyn Bridge and Capable of Carrying Much More Traffic, Can Be Completed, as the Engineers' Report States, by July, 1926, or in About Five Years' Time. The "Woolworth Building" and the Ocean Steamship "Leviathan" Could Rest Comfortably on This Bridge Between the Two Towers, With Room to Spare.**

mended without bias and considering only practicability and economy, a bridge which should start at Sixth Street, between Race and Vine Streets, eight blocks from the water front in the city of Philadelphia, and cross the river in a straight line to Second and Pearl Streets, Camden, then curve southward to a point on Penn Street midway between Sixth and Seventh Streets.

The earliest record of a project to bridge the Delaware River connecting Philadelphia and Camden dates back to 1818. Organized effort on the present proposed structure began in 1914, and in 1919 a Joint Commission with full power and authority to proceed with construction was appointed, and on September 24, 1920, the present board of engineers was engaged to prepare a report.

Test borings were made and the distance below mean high water at which the first core-samples of rock could be recovered on the proposed site was found to be 86.7 feet on the Philadelphia side and 91.6 feet on the Camden side.

A detailed study of traffic conditions showed that the average daily total of passengers both ways during 1920 was 130,740, with nearly 200,000 on the maximum day. A bridge shuttle service is recommended for passenger transportation, with easy transfer to surface car routes. Additional tracks for rapid transit cars have also been planned.

In planning the actual design of the bridge a careful study of the four large New York City bridges between Manhattan and Brooklyn was made, and as a result it was considered best by the engineers that not less than six lines of vehicular travel should be provided for, the width from curb to curb on the main structure being fixed at 57 feet. Two ten-foot walk ways are provided for pedestrians. No roadway grades will be in excess of 3½ per cent, the trolley track grades being kept near a maximum 5 per cent grade.

All exposed masonry construction will be in granite, with backing or cores of concrete. Reinforced concrete is utilized for the roadway slab, with wood paving blocks because of their light weight. With no chance of a draft underneath, these could not burn, and the entire structure will be entirely fireproof.

The engineers decided in view of past experience that the suspension bridge involves less risk in construction, and can be manufactured and erected more quickly. A total of 33,000 tons of metal will be required, whereas a cantilever bridge would use 47,000 tons.

The versed sine, or vertical distance between the highest point of the cable curve at the towers and its lowest point at mid span will be 200 feet.

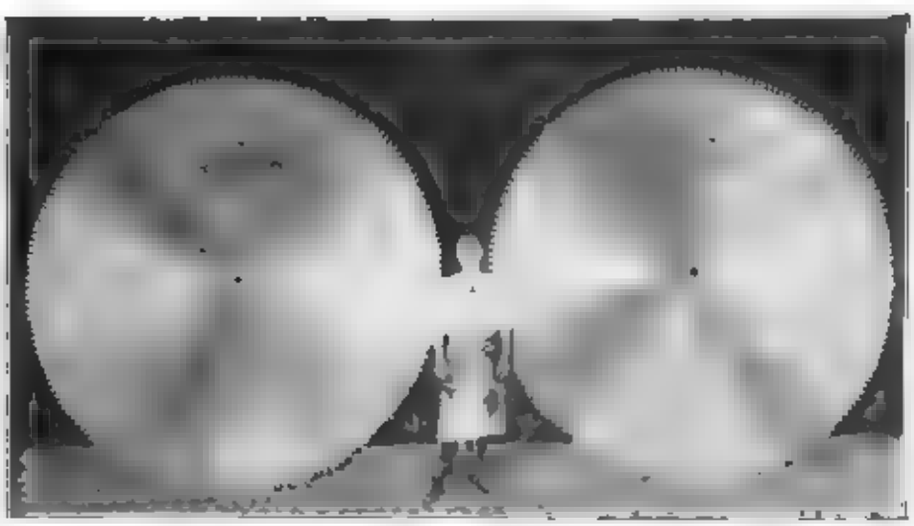
The East River bridge in New York has cables 20¾ inches in diameter, but the choice of a two cable design for this new project requires a notable increase in cable diameter to 30 inches. Each cable will contain 16,500 wires of No. 6 size (.192 or about 1/5 inch in diameter).

The towers will be of steel, rising about 380 feet above water level and will be 40 feet wide at the base and 12 feet at the top.

Then came the question of approaches. Cutting into two cities where great condemnation of property would be necessary no matter what site should be selected, the engineers have carefully picked their way, and it is on this feature as much as any other that they recommend the Franklin Square-Pearl Street site. Roadways on both approaches will be widened to 63 feet. A plaza occupying two city blocks is planned on the Pennsylvania side, thru which run four roadways radiating from the central open space at the bridge end. West of this plaza is Franklin Square, a city park, providing plenty of open space.

# The Largest Saws in the World

Henry Disston and Sons have a world wide fame for their saws and a visit to the factory, for the privileged few who are admitted within its precincts, is most interesting. In spite of modern machinery and the last improvements, there is a great amount of handwork involved in producing perfect saws. As turned out from the machines there are always hard spots and strains which have to be coped with by the most skillful hammering with a peculiar hammer, the saw resting on an anvil. The huge circular saws



we illustrate, are 108 inches in diameter. They are to go to the Pacific Coast to be used on the great trees of the coastal forest. There are 190 teeth inserted in the rim. It is the most impressive sight to see lumber handled in the Tacoma Mills, and the work of such saws as these is well worth seeing.

**Two Huge Circular Saws Nine Feet in Diameter to be Used in Cutting up the Great Trees of the Pacific Coast**

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# Science and Invention

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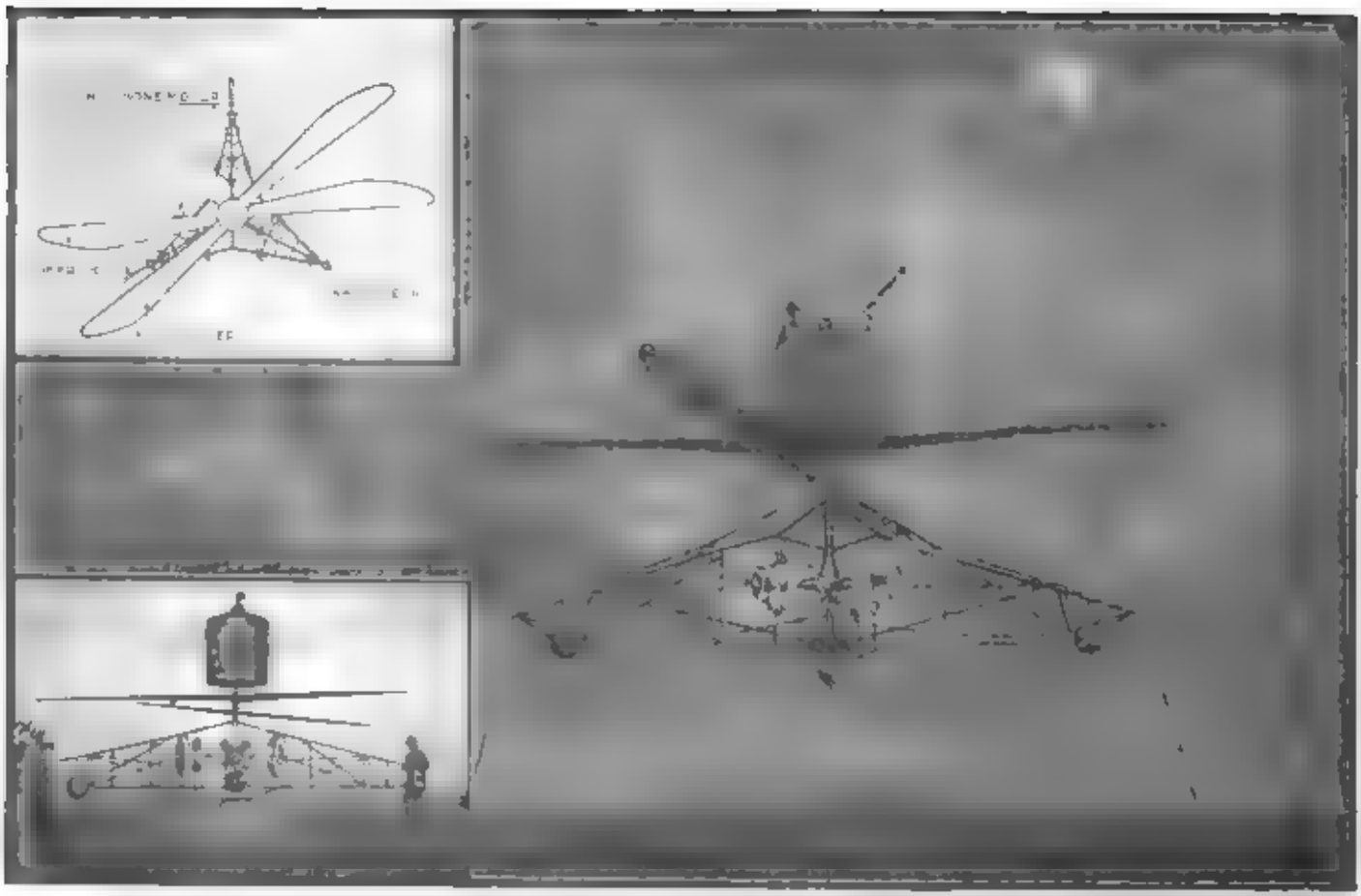
## SIGHTSEEING CAPTIVE HELICOPTER

*See Page 418*



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**Upper Left.—The Petroczy-Karman Machine as Viewed From Top. Lower Left.—Actual Photograph of the Same Machine Just Before Flight. This Machine Actually Made a Great Number of Ascensions**

**Center Illustration.—A suggested Use of the Captive Heliocopter. Astronomers Have Always Felt the Need to View Celestial Bodies From a Great Height in Order to Get Rid of the Atmospheric "Boiling" Effect Which Precludes Good Seeing. By Using the Captive Heliocopter and Ascending Several Miles Above the Surface of the Air, Valuable New Knowledge Would be Gained, as at Such Heights Astronomical Observations Would be Greatly Improved.**

# A Captive Heliocopter

## By H. GERNSBACK

WE have publisht in these pages descriptions and illustrations of a number of heliocopters, as our readers are well aware. So far, nothing really worth while has been produced, and most of the heliocopters, that have been built, do not seem to be able to keep their equilibrium when aloft. A sudden gust of wind is almost certain to throw them over with disastrous effects. How is this effect to be overcome?

During the war there was produced a machine that actually flew, or rather rose, to a great height, and stayed there as long as the motors revolved. This machine is shown on this page, and was constructed by two Austrian army officers, Messrs. Petroczy and Karman. It was a heliocopter, which was to be used at the front for observational purposes, instead of the usual blimps or observation balloons.

In our illustration in the upper left hand corner, the construction of the machine is clearly indicated. The structure comprises an equiangular, radial, three-armed skeleton as shown, made of steel. In each leg of the frame work is placed a powerful 120 H P. Rhone gasoline motor. The three motors are all coupled to the central axes, which support the two powerful propellers, which have almost twice the diameter of the frame work. These propellers rotate in opposite directions. The idea of using three motors was adopted simply in order to keep the machine aloft, should one of the motors stop; or even if two motors stopped, there would be still one motor to operate the propellers to prevent a violent descent of the machine.

In the small lower view, our illustration shows the actual Petroczy machine before flight. We now come to the novelty of the machine, and that is the means to stabilize it, and to overcome the danger inherent in most heliocopters, which is the accidental turning over of the machine while in flight. The inventors used three cables, which were fastened one to each point of the triangular steel structure as shown. These thin steel cables were reeled out by means of three electric winches as the machine rose upwards, the cables remaining taut at all times, while the machine was in flight. These cables effectively stabilized the machine, and many ascensions were made.

When it was desired to come down, the propellers were simply rotated slower, and the landing was made without trouble. The three large steel balls suspended at each point of the star like structure are also for stabilizing purposes, keeping the center of gravity below the motors. All of this helps to keep the machine from upsetting while in flight.

The deplorable part about this machine is that its efficiency was very low. The machine itself weighed about 1,300 pounds, and it took 360 H P. to lift it, which is bad mechanics. This trouble was due to the fact that it had not been realized at that time, as it has since been demonstrated by our own inventors, as for instance, our Mr. Cooper Hewitt and the late Professor Crocker, that the secret of the heliocopter lies in enormously large propellers. If such propellers are used, the efficiency of the machine increases very considerably, because the power necessary to lift the machine decreases proportionately.

We are certain that we will see these machines in use for sight-seeing purposes, once they are perfected. Our suggestion on the front cover shows this graphically. One of the most important uses for this machine, however, will undoubtedly be for astronomical purposes, as depicted in our large illustration. It is a well-known fact that all astronomical observations today are dependent upon the atmosphere. Even on clear days the "seeing" is not always perfect, due to the "boiling" of the air. If astronomers could ascend five or six miles above the surface of the earth, and mount their telescopes on a reasonably steady platform, it is certain that such a device would enrich our knowledge in astronomy enormously. Of course, the Captive Heliocopter will probably not be perfected for many years to such an extent that it will be possible to actually take photographs of celestial objects while the machine is at a height of several miles. The vibration and swaying of the machine would doubtless preclude the taking of such pictures, which require a very long exposure, but for viewing celestial objects, as for instance, the moon or Mars by means of a powerful telescope and using the eye, we are quite certain that the Captive Heliocopter would prove a great boon to our astronomers.



www.americanradiohist...

Imagine These People to be the Tiniest Figures, Then What They Would See Inside of a Piece of Sugar Is Here Portrayed. The Rings of Electrons Spinning Around Their Respective Nuclei Would Present a Most Awe-Inspiring Sight.

# Inside of a Piece of Sugar

THE modern molecule is the legitimate successor of and the word itself is the synonym of the atom of the old-time philosophers. The old atom was supposed to be the smallest possible division of matter, according to the epicurean theory. Less than two hundred years ago modern chemistry was evolved, and the old time atom proved to be divisible into smaller parts, and to these parts the name of atom was given, and the new name molecule was coined. Things went along this way very quietly until, with the study of radio-activity and its phenomena, a new conception of the atom was formed, and it was concluded, that the atom was a very open-work body, somewhat analogous to the solar system, having a central nucleus holding bound to itself like the planetary satellites of the central sun, a greater or less number of electrons, the number being invariable for the atom of each element in a neutral state.

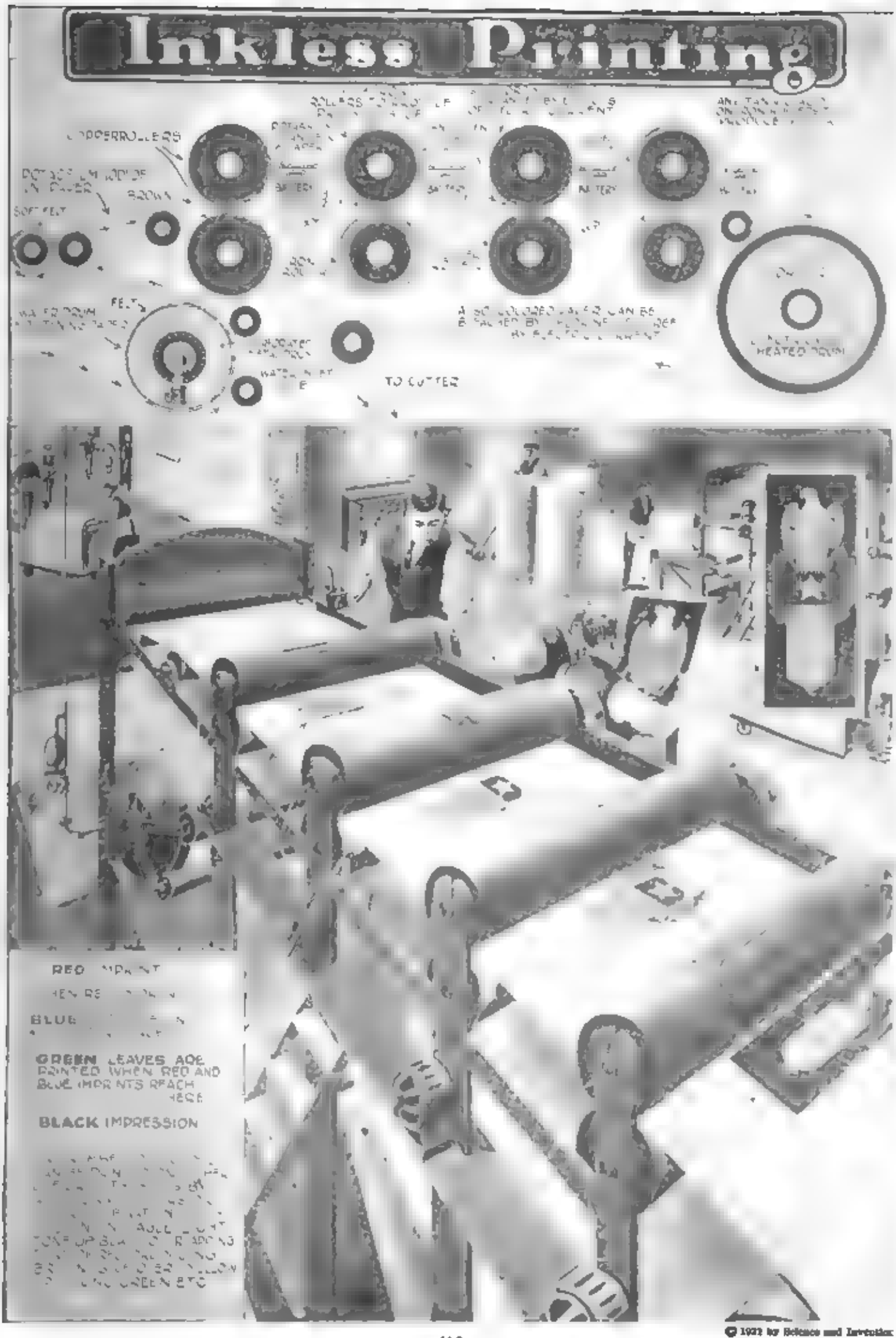
The nucleus is supposed to have the mass of the atom concentrated in it, and the empty space, between nucleus and electrons, is proportionately comparable to that between the sun and the earth. Were it possible to collect the nuclei of enough atoms of gold for instance, to fill solidly with those nuclei a receptacle of one cubic inch volume, the cubic inch would run up into hundreds of tons weight.

Each atom is charged with energy, exactly what goes on between electrons and nuclei we do not know, but if we could unchain the energy of the atoms, the coal mines could close, we would cap the oil wells and consign hydraulic power stations to the scrap heap.

In our last issue we showed some pigmy

(*Continued on page 471*)

# Inkless Printing

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# Science and Invention

REVEALING
YOUR TRUE VOCATION

*See Page 514*

Volume IX
Whole No. 102

Science and Invention

H GERNSBACK - EDITOR
H.WINFIELD SECOR,- ASSOCIATE EDITOR
T.O'CONOR SLOANE, Ph.D.- ASSOCIATE EDITOR

OCTOBER
1921
No. 6

# An Octopus That Never Lived

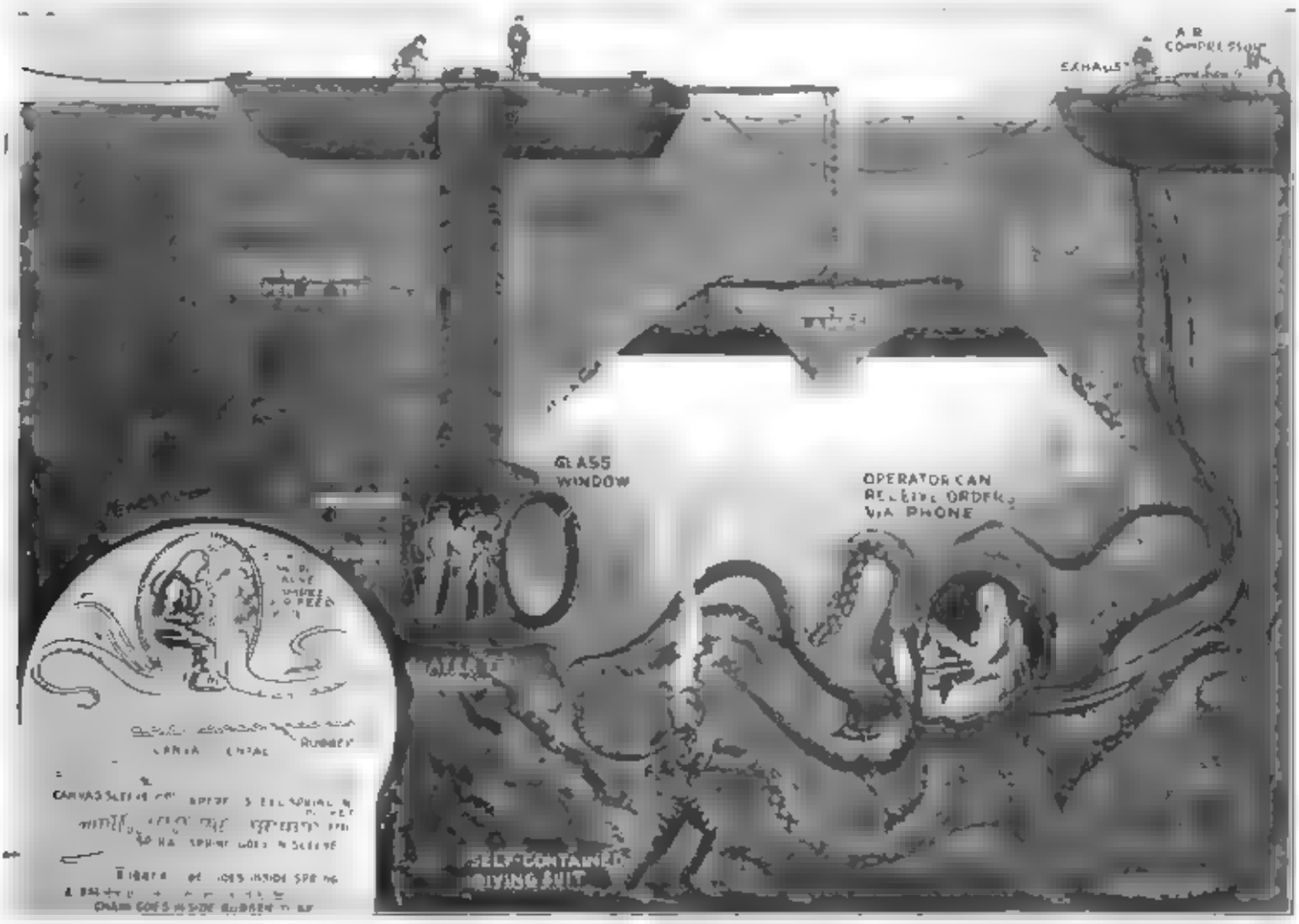
POSSIBLY you were fortunate enough to have witnest the famous motion picture taken under the sea, in which a man fights a battle with a terrifying octopus, or devil-fish. If you did see this picture you undoubtedly were puzzled as to how this undersea battle was actually staged in photographing the scene. The interesting details of how the uncanny and lifelike movements of the long slashing tentacles of the octopus were produced, are given in a patent recently issued to John Ernest Williamson. The arrangement of the machinery used in producing this remarkable undersea picture, is shown clearly in the accompanying illustration.

To start with, the motion pictures were taken with an ordinary *movie* camera placed in a watertight compartment at the bottom of the tube shown in the picture. The compartment containing the movie camera, the photographer and the director, was left open to the air, and as the tube was watertight at the bottom and along its entire length, the men at the bottom of the tube received plenty of fresh air at all times. Electric light and telephone wires were led down into the photography room, orders being given by telephone when necessary to Mr Octopus—who was personified by none other than a full-grown man, who had carefully studied the movements of this particular undersea cephalopod—so that, by varying the amount of compresst air forced into the hollow, flexible tentacles, very realistic movements of the latter were effected.

The man who sat inside the body of this made-to-order octopus was equipt with one of the new style self-contained diving suits, which are fitted with the necessary oxygen and other tanks, and carried on the back, so that no rubber tubes for supplying air, etc., were necessary so far as he was concerned. Two small sized rubber tubes were led from the body of this pseudo-octopus to the surface of the water, where one of the tubes connected with a motor-driven air compressor, while the other was simply secured to a length of pipe open to the atmosphere, so as to serve as an exhaust.

The central body shell of this awesome looking devil-fish was built in two parts hinged together, so that the operator could easily enter or leave it. Owing to the arrangement described and by utilizing the self-contained diving suit, no air

(*Continued on page 571*)

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**"In the Movies They Do It." What? Why Build Deep Sea Monsters to Order. This Monster Octopus Never Lived, Yet Thousands of Photoplay Fans Have Seen the Battle Between the Terror of the Deep and a Man, and Could Have Sworn That it Was a Real Honest-to-Goodness Octopus. Compresst Air, Admitted to or Released from the Canvas Tentacles, Caused Them to Curl Up in That Creepy Fashion That Makes You Shiver. Electric Lights Helped to Illuminate the Scene Under Water, While Telephone Orders Could be Given to the Man Inside the Octopus. The Photographer was Located in a Water-Tight Tube in the Manner Shown. A Self-Contained Diving Suit Was Worn by the Man in the Octopus.**

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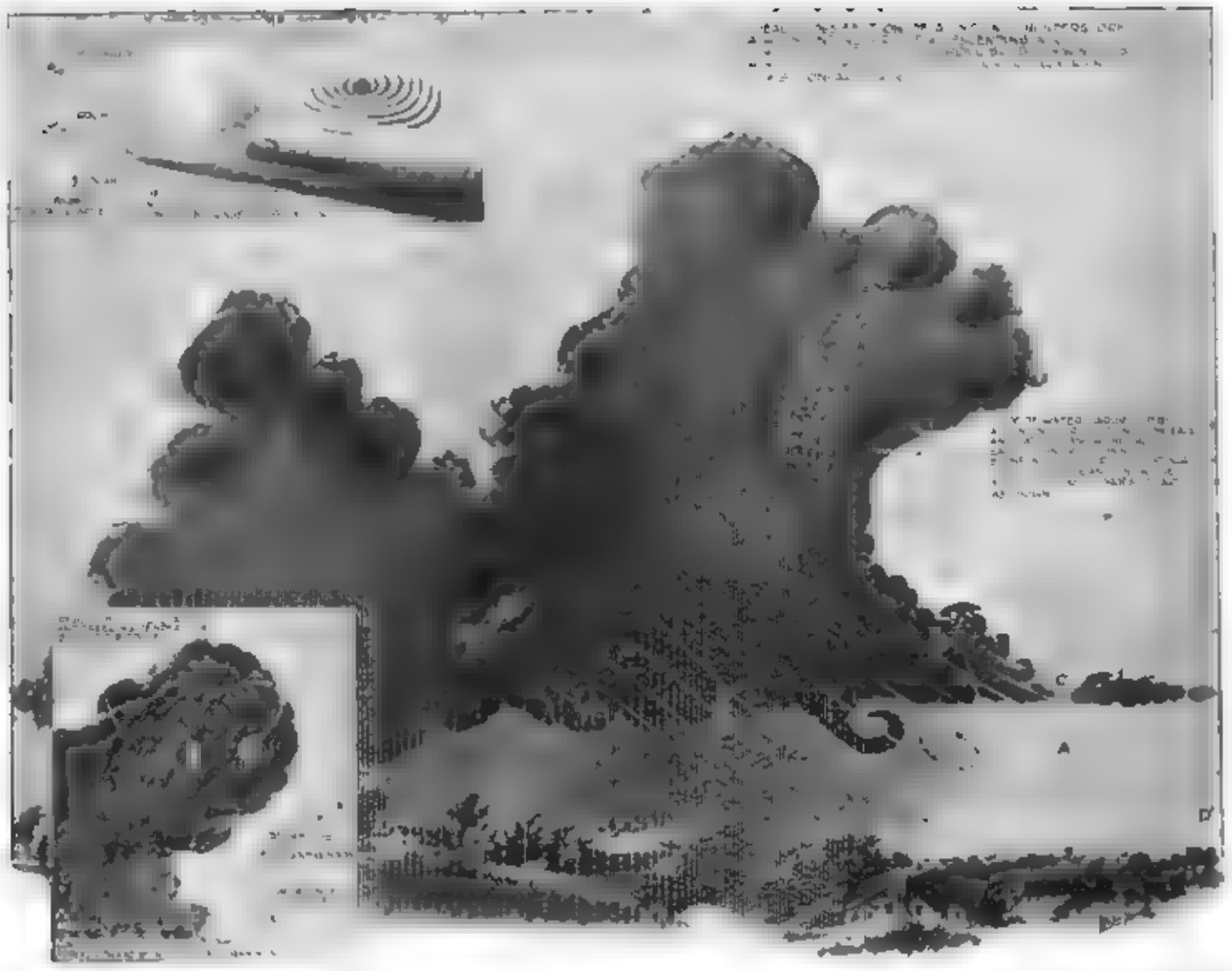

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**A Remarkable Hailstorm Passed Along the Ramapo Valley Near New York City About a Month Ago, and During This Storm Hailstones as Big as Baseballs Fell. Conservative Measurements of the Thousands of Hailstones That Fell Gives 3½" Average Diameter, as Shown in the Upper Left-Hand Illustration, but Much Larger Ones Also Fell. The Central View Shows the Formation of a Thunderstorm from Which Hail Falls, the Hail Being Formed in the Upper Cloud Layers at "H," and Not in the Region of the Roll-Scud "S," as Previously Believed, According to the Latest Scientific Understanding of the Subject. The Reason Why We Have Two Periods of Maximum Rainfall During a Thunderstorm, and Often Mistake This for a Thunder-storm Returning, Is Made Clear by the Position Shown Where Two Maximum Rainfalls Occur "R" Primary, and "R-1," Secondary Rain. Lower Left Insert Shows How a Nucleus of a Hailstone Is Formed From a Congealed Drop of Water Carried Upward by the Rising Air Currents "A" as This Congealed Droplet Rises to the Colder Cloud Layers, It Is Frozen, and After Falling and Rising Several Times, Successive Layers of Snow and Ice Are Formed Around the Nucleus and Eventually It Falls to Earth, Looking Like the Mysterious Object Shown in the Upper Left View.**

# What Is A Hailstone?

An exceptionally severe fall of hailstones, some of them as big as a man's fist, accompanied a thunder-storm which moved along the Ramapo Valley on July 31st, doing a great deal of damage to buildings, live stock and crops. H W Secor, of the editorial staff of this journal, who resides near Suffern, N Y , which is about 32 miles from New York City, had the opportunity of witnessing this unusual fall of hailstones which occurred in the first part of the thunder-storm at about 3.00 o'clock in the afternoon and also measured a number of the hailstones; many of these had a diameter of from 2½" up to 3½", that is larger than a baseball, or about the size of an orange The hailstones greatly resembled snowballs which have been soaked with water and then frozen, in some cases they pierced the shingle roofs of houses and of course broke hundreds of windows. One green-house had practically every pane of glass in it shattered, and automobile tops were punctured as easily by these hailstones as if they had been made of paper. Many animals were severely cut by them and several people driving automobiles were injured so that they, in at least one case, lost control of the car, the hailstones falling naturally with a very high velocity Some of the smaller and solidly frozen hail stones, about 1" in diameter, made holes in the ground and buried themselves from 6 to 12 inches deep

The upper left insert gives a clear idea as to the gigantic size of the hailstones which fell in Suffern and other adjacent towns along the Ramapo Valley. There were larger stones or conglomerate masses, possibly composed of several hailstones frozen together, which appeared to measure 5 to 6 inches in diameter, but which broke up on hitting the ground or rocks, roofs, etc., so that they could not be measured. The shape of the hailstones varied considerably, as shown in Fig 1, some of them being almost perfectly round like a musket ball, while others were irregular in shape; some as large as baseballs were more pear shaped or else oval, and had several rough jagged horns protruding at one side, possibly due to their outer coating of ice or snow, having partially melted on their rapid descent from the clouds and the tendency of the descending mass to assume a stream-line shape. When some of the larger hailstones happened to break in half on landing, a very peculiar layer formation or structure was at once noted This is shown also in Fig 1 At the center appeared the nucleus of solid black ice and in succeeding rings around this nucleus were frozen alternate layers of snow-ice and clear ice So much for the hailstones themselves, but what interests us most, undoubtedly, is as to how these mysterious missiles from the sky form and build up, and they certainly do build up in successive layers, as seems logically certain from their structure, as shown in Fig. 1.

[redacted]

Several different theories have been advanced as to how hailstones actually form, but the one usually accepted by meteorologists is as follows: A drop of water in the lower part of the thunder-cloud is caught by an uprushing stream of air, and carried upward until it reaches a higher zone of cold air, where it congeals or becomes partially frozen. As the drop of water ascends still farther, it reaches an altitude of possibly 5,000 to 8,000 feet, where the drop of water becomes frozen

(*Continued on page 552*)

# Subways of Tomorrow

REGINALD PELHAM BOLTON, a well known engineer of New York City, recently created quite a furore in rapid transit engineering circles, by making a number of radical and bold suggestions as to what the subway system of tomorrow will resolve itself into.

"To begin with," said Mr. Bolton to the writer, "we are already beginning to feel the intense pressure of the ever-growing population and transit problems of New York City, and of course the same line of reasoning holds good for other American cities, where the population and housing is becoming congested. It is very evident, when we stop to think about it for a moment, that the subways, which we have today, are not going to solve our problems when the morrow arrives. It is a little difficult perhaps to conjecture as to what New York City, and this applies to all large cities in general, is going to look like 20 or 40 years hence. If we are to fulfill our duties properly, we should design our subways to provide for the future millions of people who will settle in these districts.

"Twenty-five million," said Mr. Bolton, "is the logical estimate of the population which will call greater New York City *home* in the year 2,000, but 79 years beyond our time. Of course that is quite a long way off, but when we plot the curve of the growth of New York's population and continue this curve for the coming years, we find 11,000,000 population indicated only 29 years hence, or in the year 1950, this great American metropolis and sea-port will then have at least 11,000,000 souls in its environs, while 1975 will undoubtedly see the population, based on the past rapid growth of this city, rise to 16½ millions; even now, if we consider some of the districts adjacent to Manhattan and Brooklyn, we practically have a population of nearly 8,000,000 souls."

At the present time, as Mr. Bolton pointed out, we have the anomalous condition of one of the world's greatest cities growing outward principally in but one direction—toward and out Brooklyn way—so we find that thousands of New Yorkers, due to transit conditions prevailing at present and in the past, have failed to realize what a wonderful stretch of country lies to the west across the Hudson River, in New Jersey.

The greater New York of 25 to 40 years from now will cover a vast area like a great circle, with a diameter of at least 50 miles. Let us imagine that the center of this circular area is located at the Grand Central station on Manhattan Island, or at the intersection of 42nd Street and any one of the avenues which cross it. The man or woman who works in Manhattan will not be able to find a home on this small island at that time, and they can hardly do so now, even when they are willing to pay an exorbitant rental; so they will dash north and south, east and west, from their respective offices and factories, toward the great central high speed subway station located probably in the neighborhood of the Grand Central or Pennsylvania Railroad terminals.

This giant station will eclipse either of the present two famous railroad terminals in size; escalators or moving stairways will carry the people down to a lower floor, from which a dozen or more high speed elevators carrying from 50 to 100 people each, will descend to a depth of 400 to 600 feet, where the commuters will board the high speed subterranean railroad trains, which will hurl them homeward at a speed of 60 to 70 miles an hour or more. The electric elevators could travel at a speed of 700 feet per minute. Stations along the lines of this high speed direct route subway system of tomorrow will be located from five to ten miles apart, from which points the suburban dwellers will pursue their way to their homes via surface lines, by motor or via sub-surface subways.


## Feature November Articles

*Flying Railroads of Tomorrow—Giant Electrically Propelled Cars.*

*Earthquakes Made to Order—How they do it in the movies. Specially illustrated and described.*

*Sand and Water Spouts—How Formed. With pictures.*

*Electric "Wash-out" Signal for Railroads.*

*New Subterranean Tunneling Machine. By C. S. Corrigan, C.E.*

*"The Filled Tooth"—A mystery tale of Science, Love and a Girl. By Charles S. Wolfe.*

*Denizens of the Ether. By Harold F. Richards, Ph.D.*

*How to Make and Use a Macro-photographic Camera. By Dr. Ernest Rode.*

*Our Glands—Their Tremendous Importance to Our Health. By William M. Butterfield.*

*Ultra-Violet Light—Some practical applications of these little-known rays By Dr. T. O'Conor Sloane, Ph.D., LL.D.*

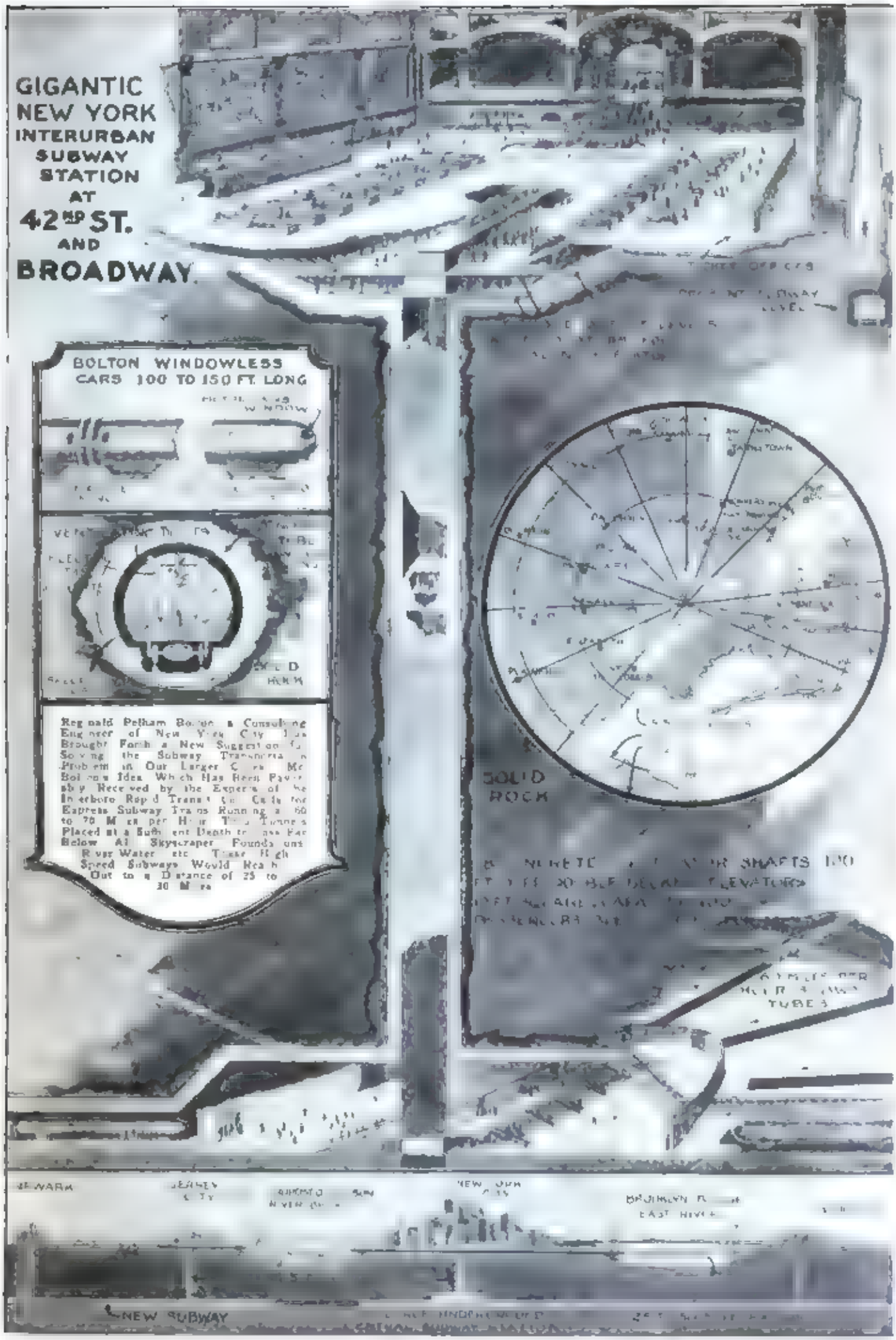
*A Short Wave Regenerative Set—A compact, simple and efficient vacuum tube receiving set By William H Grace, Jr.*

*How to Make a Model Theater—Well illustrated with actual photos.*


The wonderful simplicity and flexibility of Mr. Bolton's idea lies in the fact that with such a centralized subway system running at great depths underground, the routes may be made in practically straight lines, radiating like the spokes of a wheel, as the map shows. The tubes themselves, Mr Bolton suggested, can be made entirely of concrete, without any iron inner linings, like those used on the Hudson Tunnels. His basis for this belief is founded on the remarkable Catskill water aqueduct which runs for nearly 100 miles far under the earth. The details of this huge concrete tube and how it was built are described in detail in the Proceedings of the Institute of Civil Engineers, which can be consulted at any library and prove interesting indeed.

The trains, which will run in these subways, will have many innovations. "Why break up their stream-line surface or contour by placing glass windows in them—make them window-less, there is nothing to see except the smooth wall of the tube," said Mr. Bolton. The cross-sectional shape of the cars should be round and not irregular, as at present; the nose on the forward car should be made of hyperbolic form so as to cut the air more efficiently. Ventilation thru these deep underground subways will be effected by the piston-like action of the high speed train as it rushes along. The construction air shafts can be left in place, at say ¼ to ½ mile intervals, and emergency elevators may very well be placed in these shafts, finally they will serve to help solve the ventilation problem. Consider a train moving along between two of these air shafts: it will suck air down thru the shaft it has just past, and force air ahead of it and up thru the shaft ahead of it. By making the train of circular cross-section so as to more properly adapt it to the circular shape of the tube, it will approximate the true piston action, such as we have in the air-rifle, or engine cylinder. Suitable ventilation holes or openings are to be arranged in the front ends of the train, and along the sides, so that plenty of air will pass thru the train; sufficient space is left between the steel shell of the car and the tube wall itself, so that some air can pass by, in order that the train will not encounter too great a head resistance.

"The trains should be arranged to pass out along one tube and return thru another entirely separate tube," said Mr Bolton, "and the tubes may run close to and parallel to each other, but where it might seem desirable for various reasons, the return tube may be situated some distance from the outgoing tube." Mr Bolton is a firm believer in large elevators and suggested that unless the conditions warranted it, the high speed subway need not come to the surface even at the end of a 40 or 50 mile run, but that giant electric elevators could be readily built to lower the rolling stock, that is the cars themselves, down to the tube level. The length of a 10 car train in the New York subway at present is about 440 ft. Said Mr Bolton, "Why not have these subterranean high speed railways of tomorrow run in practically straight lines and equipt with long single car trains several hundred feet in length?" If we follow this design there will be a considerable gain in the efficiency of operation, for where various sections or cars in a train are continually swaying, there is an appreciable loss in energy, owing to the increased head resistance encountered, especially at high speed, due to the overhanging of the front surfaces of these cars, as they swing into and out of line with the other cars, and further, there is a loss due to the pocketing of air at the junctures between the cars, which is a factor worth considering when speaking of such high speed subways. "It is one thing to specify high speed, and another thing to obtain it" said Mr. Bolton. "The New York subways are supposed to attain a speed of 40 miles per hour for express trains, but they have never reached their contract stipulation, and the express trains realize an average speed of but 24 miles an hour, from station to station."

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Drawn by E. M. [illegible]

# Renewing Your Blood

**By H. W. SECOR and J. H. KRAUS**

FIFTY, yes even thirty years ago, physicians used to treat their patients mostly by guess-work—professional guess-work if you please—but with all their knowledge of *symptoms*, they frequently did not know just what was the matter with their patients, particularly the condition of the blood. To-day every physician knows that in the case of many ailments he must have a chemical analysis made of the patient's blood before he can prescribe the proper treatment. Especially is this true where a person is suffering from some skin disease of which there are about 150 in 9 classes. Many of these skin diseases, just to mention this one branch of pathology, are due to the improper chemical composition of the blood; for example, the blood may contain too much uric acid, or perhaps an overpercentage of sugar, et cetera.

## Purifying the Blood by Removal from Body and Treating it Electro-Chemically

There are two principal methods in use at the present time for correcting improper chemical conditions in the blood, and also for destroying disease germs (in the blood), and these are: First, by administering internal medicines in the form of draughts swallowed by the patient, which thus act on the blood indirectly thru the walls of the intestines, while the second method involves the injection of the medicine or serum directly into the blood stream by means of a hypodermic syringe. In Europe, and in other parts of the world outside of the United States, it is much more common to administer medicines intravenously or directly into the blood stream, and this technique is very advantageous for two reasons. In the first place, the medicine acts many times quicker and much more powerfully than when taken into the stomach, and, again, the patient is not liable to suffer by any impairment of the digestive processes, caused by taking powerful doses into the stomach.

In presenting the idea here illustrated and described, for purifying the blood by washing or treating it chemically and electrically, the authors have endeavored to substantiate their arguments by careful analysis of the various problems involved and also by direct experiments. Briefly explained, the *modus operandi* consists in extracting the blood from the body, either wholly or in part, and purifying the blood chemically or otherwise then re-pumping this blood back into the body. The first method, which was tried out experimentally, but which now has been abandoned, was to extract all of the blood from the body, and as this was done the veins and arteries were kept dilated or filled with a substitute solution, such as saline (salt water), or Locke's solution, the pressure in the veins being kept approximately constant by checking with a blood pressure gage as-

(*Continued on page* 559)

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If This Method of Purifying the Blood Were Used in Our Hospitals, and Worked Up to the Final Point of Perfection, Many of the Diseases so Prevalent Today Could be Removed from the System. The Blood from the Patient Passes Thru Electrically Heated Apparatus. In the First One (A) We Could Administer Various Antitoxins and Serums, Such as Pollen Antigen for Hay Fever, etc. A Food Can be Inserted in the Second Dropper, Such as a 5% Glucose Solution and Saline or Anticoagulant in the Third Dropper. An Animal Membrane Divides This Chamber in Half so That, by Osmotic Action, Urea Can be Filtered from the Blood. In the B Chamber Any Other Nutriment or Medicant Could be Used Such as, Arsphenamine (Neosalvarsan). And in the C Chamber the Blood Is Acted Upon by Properly Regulated Ultra-Violet Rays Which Will Kill All Other Bacilli. The Pump at D Will Assist the External Circulation and at E We Have [illegible] Batteries. The Heat in Each of the Chambers Should be Kept at as Near Body Temperature as Is Possible, Unless We May Find It Necessary to Heat the Blood to a Higher Degree and Cool It Again to the Proper Temperature, in This Manner Killing Some of the Bacteria. All Operations Must be Carefully Watched and Regulated. The Patient Is Not Placed Under Anesthesia During the Process, Local Anesthesia Sufficing for the Minor Incisions Over the Median Basilic Vein.

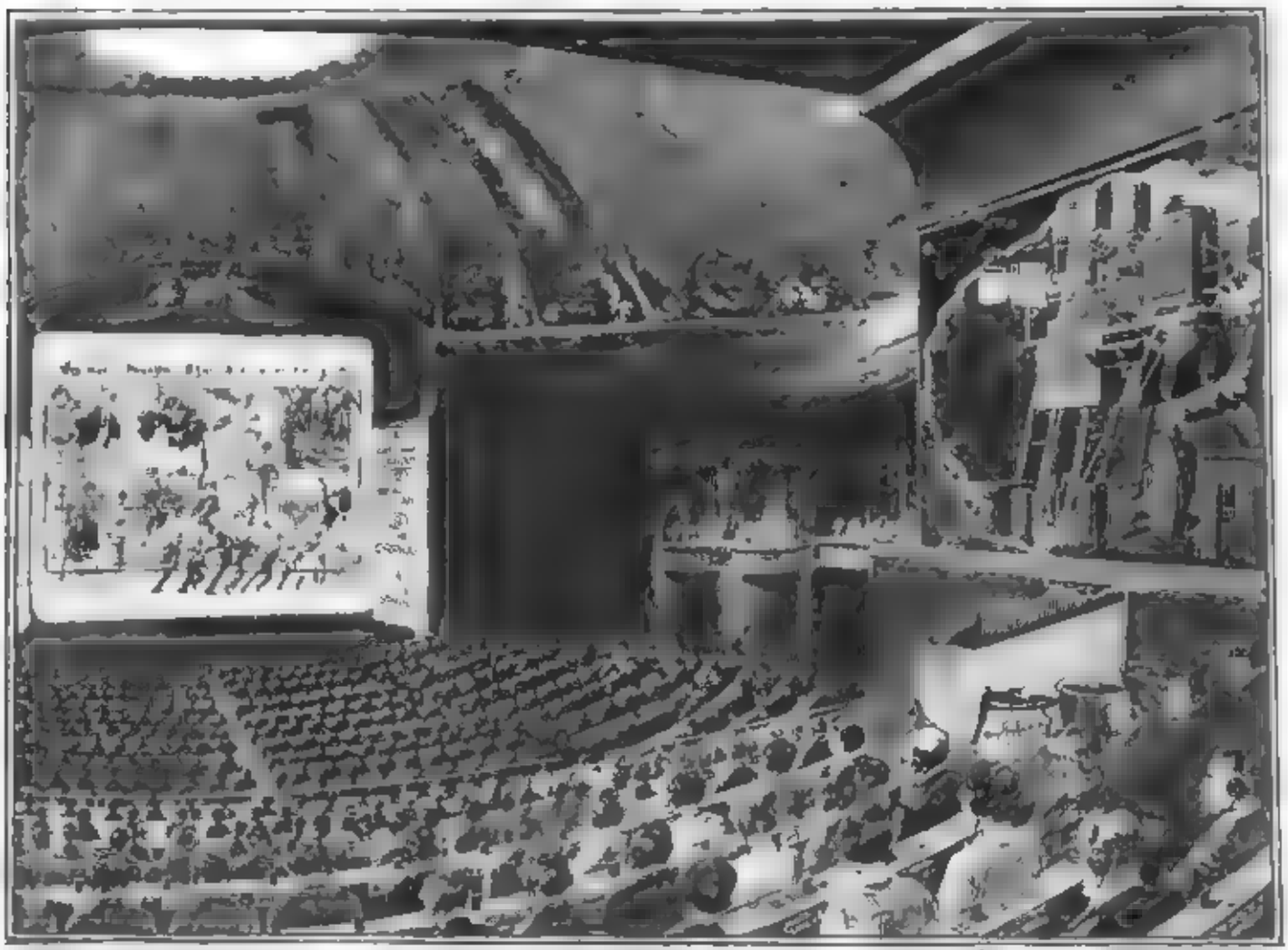


Google

# A Scientist's Dream of Future Movies

TODAY when you purchase a ticket to see a motion picture show, you can only see one film thrown on the screen at any one time. But tomorrow says the scientist, things will be changed. You will not be limited to one film, but can see any one of a dozen or more, all for the price of one admission, at any time, and all from the same seat, comedy, drama, science, travelogs—all will be at your instant command. On the back of the seat in front of you there will be a clever selective device, which will release the proper colored glasses to view the particular movie you want to see, and simultaneously switch in to circuit the proper music for the telephone receiver you snap over your ear. Several motion picture projectors flash their views on the screen simultaneously, each one in a different color. To each projector is connected—synchronously—a phonograph fitted with the appropriate music. Audion amplifiers intensify the music sufficiently to supply hundreds of chair phones. The colored glasses act as filters. To see comedy, for example, you use yellow filter glasses, which permit only this color to be seen. Red glasses show us a melodramatic film, if that is the color used to portray it, and so on down the list.

This wonder movie theatre is a large spacious hall fitted with arm chairs, and as we enter it, we see all about us people in different moods—some gay and others not so gay. Each one has fastened over their head an ordinary pair of telephone receivers, and each one is viewing a picture with different colored eye-glasses. Some are laughing, some have tears coming from beneath their glasses, and still others are in an intense mood of excitement. We take our place in any empty seat which we can find in this packed house, and look up towards the screen. On either side we see the names of the features upon an electrically illuminated sign and immediately under these names, the actors playing the leading roles. Should we feel in a mood for comedy, we push the slide on the back of the seat in front to a point marked "Number 3," for instance. An automatic catch now releases a pair of special colored glasses from this compartment. We adjust these glasses and also a pair of telephone receivers provided on each chair, and we are able to see, for instance, a Charlie Chaplin comedy and hear music appropriate to the same. Our companion may not be interested in the Chaplin comedy, and may like something more serious. So elsewhere on the program we see that a play featuring Madame Petrova will be Number 4 on the list, and perhaps the spectator will be provided with a combination of glasses more blush in color. Others again will like a submarine feature, and will see "Wet Gold" under Number 10, the Williamson production. Therefore, should we be inclined to see that exhibition we put on the specified lenses and adjust the ear-



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The Motion Picture Play of To-morrow as Forecast by One American Scientist, will Undoubtedly be Considerably Different from the "Movie" Show We Know To-day. He Suggests That We Will Have Several Different Photo-plays, Comedy, Drama, etc., Flashed on the Screen in Different Colors Simultaneously. To View Any Individual Photo-play We Will Move a Switch on the Back of the Chair Ahead of Us, Which Will Release the Proper Colored Glasses to View a Comedy Flashed in Red, Let us say, and at the Same Time the Proper Synchronizing Phonograph Music Will Be Supplied in the Head Telephone Receiver Which Each Patron Wears. If We Do Not Like the Comedy We Can Select a Drama or Travelog and Observe Them Thru Another Pair of Properly Colored Glasses With Music to Suit

phones which are, of course, automatically connected to the circuit carrying the proper music for the play.

The busy man or woman who can devote but a short time to entertainment, can learn and see more in one evening in this manner, than we would ever dream of today. If thru the red glasses he beholds a dramatic picture, which does not please him, he could immediately shift to a scientific feature or to a howling comedy. Everyone will be happy because they have at once their choice of several different classes of entertainment, and for the movie fiend, who delights in watching a picture show for four or five hours, he or she could sit there and view everything on the program.

Of course it will be quite a problem to select glasses which will operate properly

(Continued on page 576)

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December

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# Science and Invention

FORMERLY
ELECTRICAL EXPERIMENTER

## WORK AND LEARN WHILE YOU SLEEP

See Page 714

Volume IX
Whole No. 104

Science and Invention

H GERNSBACK,- EDITOR
H. WINFIELD SECOR,-ASSOCIATE EDITOR
T.O'CONOR SLOANE, Ph.D.-ASSOCIATE EDITOR

DECEMBER
1921
No 8

# A New Color-Music Instrument

## By EDWIN HAYNES

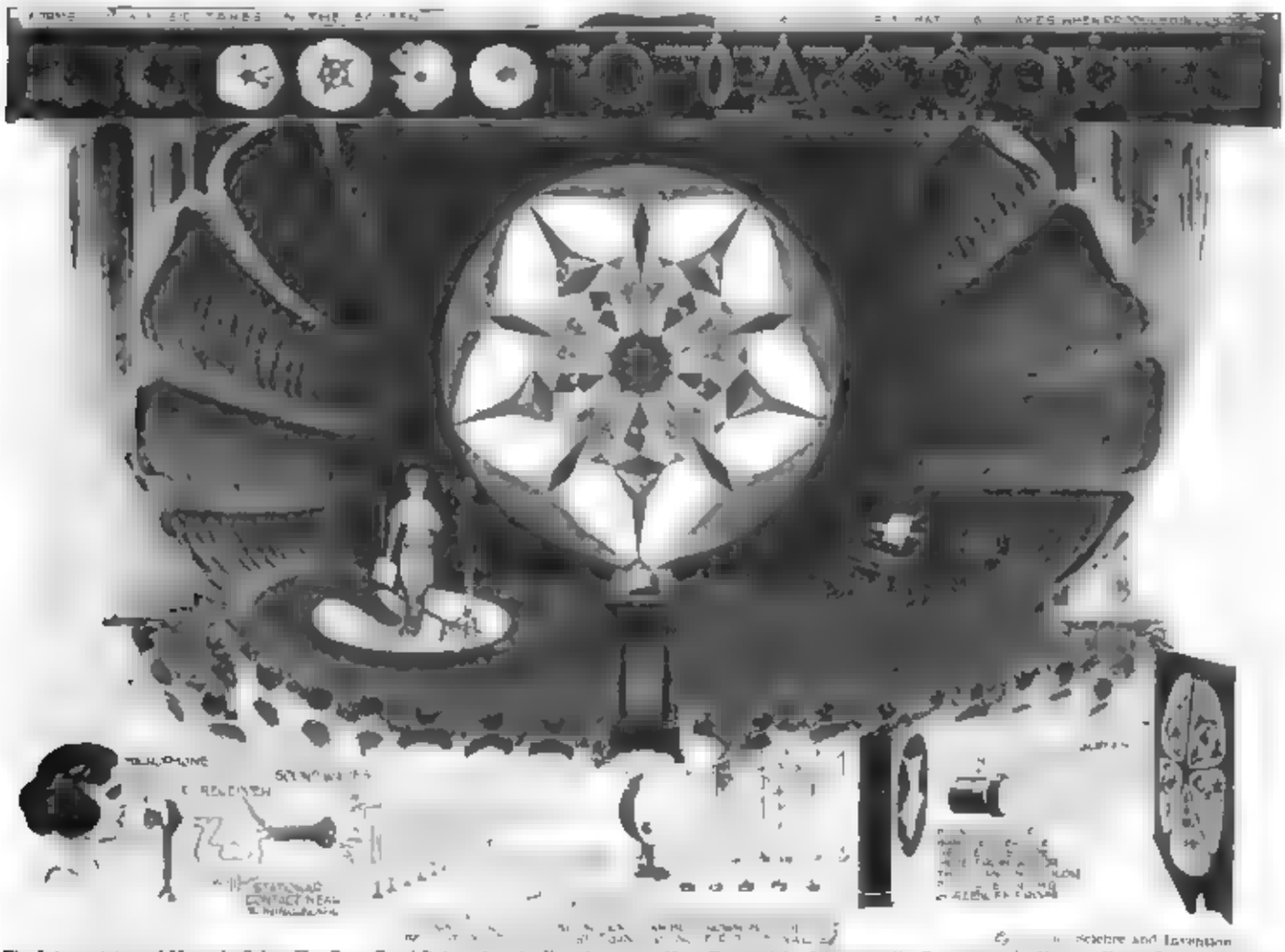
AN extraordinary instrument has been invented by William Maulsby Thomas, of Los Angeles, which produces what he terms *unison color-music*. He is an old investigator and the inventor of several important mechanisms and processes. His recent activities have been devoted to problems relating to color music and color photography.

The unison color-music instrument marks a great advance in all respects in the translation of music into colors. Its predecessor, the color organ, a cumbersome, costly mechanism, is insignificant by comparison, with regard to the results obtained. The color organ projects upon a screen colors of the visual scale, corresponding to notes of the musical scale as they are sounded upon the keyboard manipulated by an executant. Its capacity is limited to the production in sequence of colors without form.

The new instrument is compact and comparatively inexpensive—so compact that it can be enclosed in a portable case. By adjusting relations between sound vibrations and light vibrations translations are made automatically, not only of music but of all kinds of sounds. An interesting feature of the unison color-music instrument is that it gives each note of the musical scale a distinctive geometric figure and definite color, so that when an orchestral performance is translated and projected upon a screen the several geometric figures assemble themselves into a sequence of symmetrical multicolored forms, of great variety and beauty.

The unison-color instrument, like many other important devices, is technically extremely simple and easily operated. A sensitive electro-microphone is placed on a standard near the singer or singers or the musical instrument or [illegible] of instruments. In a theater or music hall, the microphone is connected by wire with the color music instrument, which is enclosed in a case about eighteen inches in each of its three dimensions, placed in the balcony just as is a projector for the production

(Continued on page 786)



The Interpretation of Music in Colors Has Been Tried Before, but the New Apparatus Here Depicted for Automatically Converting the Various Notes Sung or Played Has Just Been Perfected by a California Inventor. One of the Principal Uses for This Apparatus Lies in the Fact That the Deaf May Hear. All The Deaf People Would Have to Do Would be to Learn the Color Pattern Alphabet Devised by the Inventor and Then They Could Enjoy All the Subtle Blending of Musical Notes, Simply by Observation With Their Eyes. As Each Note of the Scale Impinges Upon the Microphone, the Tuning-Fork Resonator Rejects the Sound into a Closed Chamber, Containing Tuning Forks of Different Pitches. The Tuning Fork Which Responds to the Given Note Closes a Circuit Thru a Magnetically Actuated Color Filter. The Various Color Tones Then Pass Thru the Geometroscope and Appear on the Screen in Ever-changing Patterns

# The Glass City of To-morrow

## By WILLIAM WALSH

ARTIFICIAL heat and light have made possible the modern city. Without them, civilization would be forced to return to the tropics whence it came. They are the indispensable allies that man uses in his upward march. We have, however, by no means conquered completely such adverse elements as the heavy snows and piercing cold of winter. But science now proposes to bring about a change as effective as tho we had bottled Italy's liquid sunshine, or Southern California's balmy breath. As a consequence, the city of to-morrow will bear little more resemblance to our present centers of population than a Zulu kraal now does to the present New York, Paris, or London.

The coming city will be of glass—a vast hemisphere rising from plain or valley as if to challenge Nature in her work of creating hills and mountains. Yet this great dome will be simply constructed, assembled on precisely the same principles that the Eskimo employs when, in constructing his igloo, he lays one block of ice upon the other, till his simple but admirably devised habitation is complete. To rear his metropolis, civilized man will use blocks of transparent glass, ascending tier by tier, and cemented together.

Strong columns of solid glass will serve for supporting pillars. Except for a great door here and there and removable sections to aid in ventilation, the vast structure will be as tightly closed as the old-fashioned beehive of twisted straw. Thru the transparent crystal the light and warmth of the sun and the beauty of the moon will find ready admittance, but the icy blasts from the north will be defied.

There will be no steel frames or trusses, no iron or marble pillars—no shadows, therefore, will fall by reason of the admission of outside light. Dust and moisture will be excluded and to a solitary individual standing beneath the center of the dome, the silence would be as profound as that of the ocean depths where the Titanic sank.

But this will be no city of solitude—no abode of a single inhabitant—for it will be filled with happy, carefree men, women and children, and humanity will here engage in its wonted activities with unaccustomed zest.

Picture yourself arriving at the walls of this city some bleak morning in December. A blizzard is raging and you draw your overcoat more closely about your shivering body as you step from the train. Passing thru a series of heavy glass doors, your nostrils are greeted by the warm scent of the tropics, the odor of flowers, and the song of troupes of birds is heard everywhere in the exotic foliage. You note with some surprise that tho the skies outside were heavy with snow, here the warm rich glow of sunshine seems to be everywhere diffused.

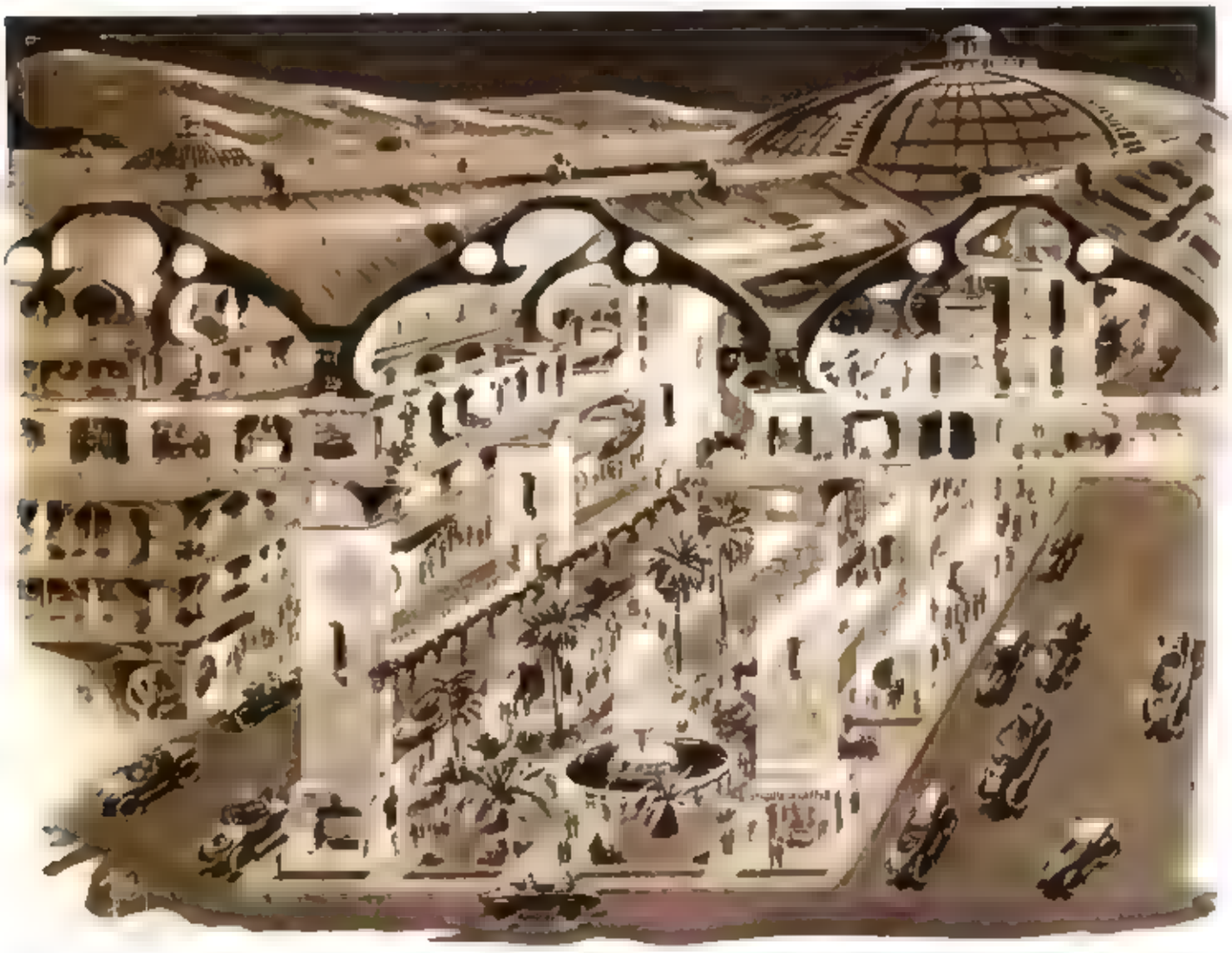
Then you enter dressing rooms provided for visitors to this crystal city, and having donned a Palm Beach suit, you set forth on your sight-seeing trip in an electric cab—gasoline automobiles are not permitted on account of their noise and their atmosphere-defiling exhaust gases.

You cannot shake off the impression that you have been transported to some magic city of the Arabian Nights. The dwellings are Oriental in architecture. They, too, are built of blocks of glass, with balconies partly concealed with vines and shrubbery.

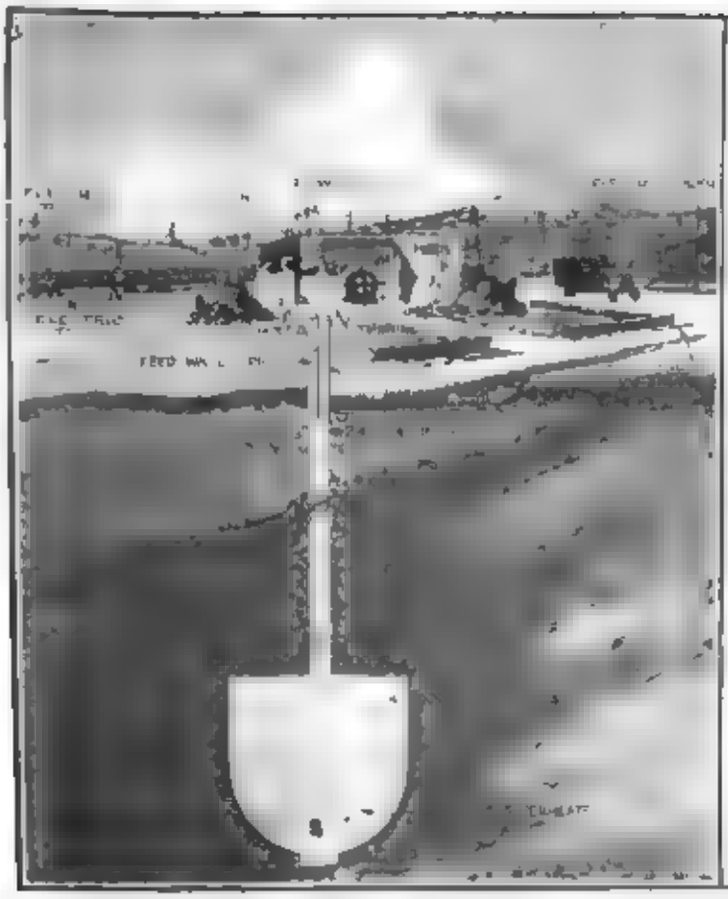
Heavy curtains and hangings within are partly drawn, to exclude the gaze of the curious. Presently also you discover that the roofs themselves are as transparent as air and that blinds under the roofs shut out the rays of the sun as required.

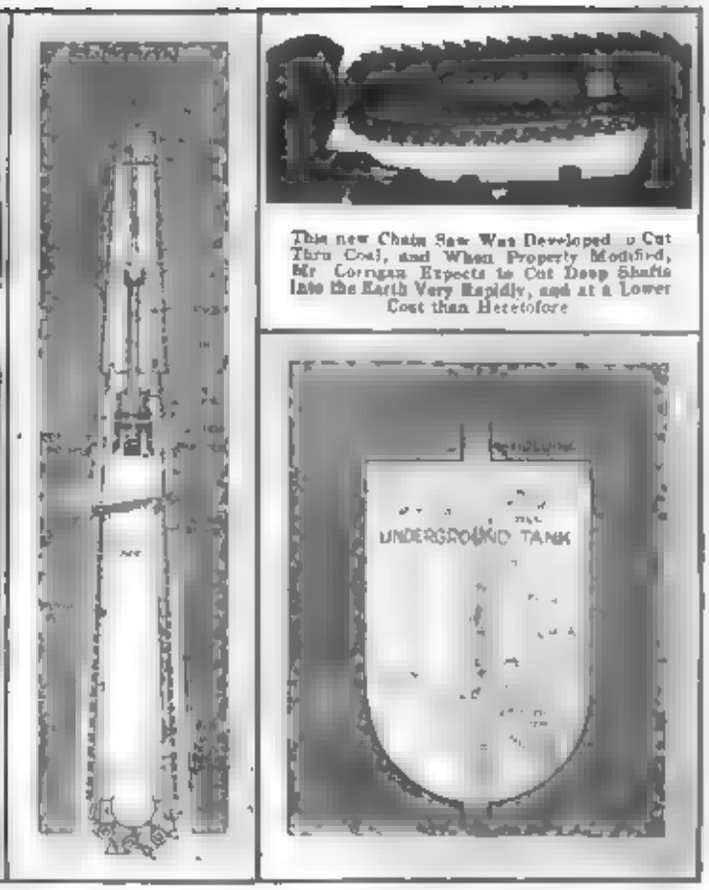
Roads and paths curve everywhere thru

(*Continued on page 785*)



The Glass Domed City of To-morrow Will be Like a Veritable Paradise, Yourself Enjoying a Climate Like That of Florida or California. The City Streets Like Sunshine Even on the Darkest Day. The Air Will be Warmed by Hot Rays Outside, but Once You are Inside the Glass City, You Will Find Mounted on the Columns. The Glass Is Heated by a Central Heating Plant, While Powerful Electric Lights Will Illuminate in Perfect Condition as Well as the Humidity, by Electric Generators and Purifiers ple of Blocks of Solid Glass, no Metal Frame Being Used.





This new Chain Saw Was Developed to Cut Thru Coal, and When Properly Modified, Mr Corrigan Expects to Cut Deep Shafts Into the Earth Very Rapidly, and at a Lower Cost than Heretofore

**Mr. Corrigan, the Author of the Present Article, Has Invented After Many Years of Research, the Remarkable Chain Saw Shown in the Accompanying Illustrations, by Which Means He Has Made It an Economical and Feasible Proposition to Cut Deep Shafts Down into the Earth, so as to Utilize the Interior Heat of the Earth. By Sinking a Shaft to a Level of 5 Miles a Temperature of 1000° F Is Reached. If Water Is Discharged into the Underground Steam Chamber as Shown, Superheated Steam Will Form and Rising, Will Operate a Steam Turbine Driving a Dynamo, etc. The Center and Right Hand Diagrams Show the Electric Motor-driven Deep Well Saw, and the Method of Sawing Horizontally to Form Steam Chamber.**

# Electric Power from Earth's Heat

## By C. S. CORRIGAN, C.E.

FROM tests carried out in deep mine-shafts in different parts of the world, science knows today that the temperature of the earth increases a certain amount for every 100 ft. we descend in such shafts. By means of a new earth and rock saw illustrated in the accompanying pictures, it is proposed to cut a shaft down to at least a 5 mile depth, at which level it has been computed that a temperature of 1,000° Fahrenheit will be reached. The operation of the electric generating system for utilizing the interior heat of the earth is shown in the sectional view of the power house and shaft. Water is fed downward thru a pipe, and when this reaches the lower part of the well or shaft, it is converted into superheated steam, owing to the very high temperature present; the steam ascends thru the larger pipe and serves to operate a steam turbine. The steam as it passes out of the turbine thru the exhaust pipe passes into a condenser of the usual type, which converts it back into water once more, the water passing down the pipe to the bottom of the shaft again. Thus the process repeats itself over and over, a fresh amount of water being added from time to time as required. The steam turbine, or turbines, drives an alternating current generator, the voltage of which is raised by step-up transformers to several hundred thousand volts so that it can be transmitted over wires for distances of 300 to 500 miles, in the distribution of electric energy for light and power. Possibly by the time this power plant scheme has been put to practical use to a very large extent, the new 1,000,000 volt General Electric Company scheme of electric power transmission and distribution will have been developed thoroly, so that electric power can be transmitted over an area extending 1,000 miles from the power plant in every direction.

To cut into the earth quickly and economically has been man's object for ages. To drill and blast has been the usual method but it is dangerous; to eliminate blasting various stone-cutting chain saws have been invented; to make the cut as narrow as possible, raised portions of the links of the chain were shaped as teeth, but these teeth wore out so quickly and entirely new chains were required so often, that they have not proved economical. Circular saws with inserted carborundum teeth are used economically in open stone quarries, but on account of their shape cannot be used underground. So called chain saws (heavy link chains with renewable picks inserted for teeth) have been developed for economically undercutting coal, but do not operate satisfactorily in stone. To undercut 5" wide the chains are run about 700 ft. per minute and have picks in the same position every 3½ ft. so 200 picks pass the same point each minute, and each pick must dig ½" deep continuously for the saw to advance 2 ft. per minute which is the average.

The new chain saw devised by the writer and shown in the photograph, was developed to make narrow cuts in coal so that it could be sawed loose on all sides and removed from the mine with the expenditure of no more time, power or waste of coal than now used in undercutting. It runs about 2,000 ft. per minute, has a set of 3 teeth every 2", so 1,200 teeth pass the same point each minute, and if each scratches 1/100" deep, the saw will advance 10 ft. a minute.

When renewable carborundum teeth are used, this chain saw will cut stone, reinforced concrete, etc. It can do all kinds of underground tunnel, shaft and mining work without the use of explosives, its work can be continuous; there is no delay on account of powder fumes or shoveling loose material; 3 shifts could be employed and more progress made in 24 hours than is now made in a month. All material being taken out without disturbing the material left, fewer props would be required, tunnels, shafts, etc., could be cut the exact size for concrete or steel lining.

Realizing the improbability of ever sinking mine shafts or large wells down to intense heat with the apparatus of the present day, I began considering other methods. Stone cutting circular saws making narrow slits, are used to a large extent in stone quarries. In coal mines coal-picking chain-saws, cutting wide slits, are used like knives for undercutting the coal; it occurred to me to combine the two ideas, so I made the stone cutting chain-saw shown, that cuts a narrow slit, and when operating can be pushed into the earth like a knife. On trial it proved very efficient; I then designed a core-sawing deep-well machine using four such saws about fifty feet long, directly connected to an electric motor and so arranged that the entire machine can be lowered into a well and operated and controlled by electric power transmitted thru the sustaining cable. Cartridges are provided for breaking the core loose and core lifters for

*(Continued on page 774)*

# Crops Grow on Moon

THE unwarranted assumption that the moon is dead and that nothing can live on its surface has caused astronomers to fail to study it, according to Professor William H. Pickering, of Harvard, one of the greatest living astronomers, who in a report on two years' observation of the moon asserts that the existence of life is more easily traceable on the moon than on Mars.

Crops grow on some parts of the moon at the rate of two a day, the day on the moon being as long as two of our weeks. They are believed to grow only in the craters, with which the face of the moon is extensively pitted and which are believed to contain water and possibly a supply of heat. Professor Pickering has discovered steam issuing from some of the supposedly dead craters. The assumption has been that, because the moon had no atmosphere and because its temperature was presumably hundreds of degrees below zero, no life could exist there.

Professor Pickering, who has made a life study of the moon and of lunar conditions, severely criticizes astronomers in general, because they have paid so little attention to it. Everybody had an idea that the moon was dead and therefore paid no attention to a world that is, perhaps, alive with creatures, maybe intelligent, and maybe not, right at our very door.

Few astronomers examined the moon, except on the terminator itself. This is because the latter is more beautiful than the other regions which are neglected because of this fact, in spite of their interest.

The "terminator," or boundary line between light and darkness, which would correspond with that part of the earth where the day was breaking, is the more interesting because the light and shadow effect shows the moon's features in relief, enabling the astronomer to make out clearly its extremely rugged and mountainous surface.

Fifty-six hours of sunlight in the crater of Eratosthenes II, which Dr Pickering made a particular object of study, evoked plant life. Nothing in Dr Pickering's report indicated that these were cultivated crops. After describing the appearance of dark patches, which sprung into existence and then faded out, he continued:

"Expressing the matter otherwise, we may say that the vegetation requires two and a half days to appear, it lasts for only two days, and then rests for three days, and then produces the second crop, lasting for four days more, which then gradually disappears in the evening shades. We thus have evidence of a variety of lunar vegetation. The wings of the northern spot begin to develop as soon as the sunlight strikes them."

These periods vary, however, in different fields of vegetation observed. Crops with different exposures vary in duration from two to eleven days, and the average is about a week.

"In quickness of development," says Professor Pickering, "some of it even vies with our mushrooms and toadstools. The crop has to be brief in order to ripen at all, and it is doubtful if any of it in the region we have described lasts through the lunar night."

Telling how dark patches and lines varied in their positions he continued:

"It thus appears that the runs on the moon, like the canals on Mars, shift their positions over the surface. In both cases the surface discoloration has changed its place. This cannot be due to mineral or inorganic forces. Life, therefore, exists on both these planets."

"Indeed," he continued later "instead of finding the moon a dead, unchangeable body, as it is usually regarded, we find that the shifts and changes taking place in certain of the lunar detail, after all the shadows have disappeared, present the chief difficulty to the selenographer (geography of the moon) who endeavors to sketch these features with accuracy."

After describing how fields of vegetation darken, spread, grow pale and shrink, Dr Pickering continued:

"This description typifies the changes constantly occuring in many well-defined lunar fields in the course of their development, changes much more marked than any occurring on Mars."

Discussing one area of apparent vegetation, which he calls the Southeastern Field, Professor Pickering continues:

"We now come to one of the most interesting of all the fields of this crater, because its changes are not only very marked, but also because they occur chiefly near the time of the full moon, so that they can be studied for several hours continuously."

After describing how the vegetation varies with different amounts of sunlight the astronomer says that the field finally acquires the pattern of a "lobster or a crab, with sharply curved claws."

"Another curved canal," he continues, "is now formed on the northern side behind the front one, owing to the interior fading of the field. The advance of the dark head of the man now progresses slowly down the crater's inner wall or floor."

Dr Pickering told of snow storms or snow "eruptions" on the moon and of discovering clouds within large craters, whose circular movements puzzled him.

"Just why the snow should shift and revolve within the crater," he said, "is as much a mystery as why the clouds within many of the crater rims should brighten successively clockwise in the northern hemisphere and counter-clockwise in the southern. It is to be remarked that, although Eratosthenes II is in the northern hemisphere, the rotation of the snow is counter-clockwise or opposed to that required by the law for the clouds. The successive brightening of the clouds can be watched by any one and is much easier to observe than the change of the position of the snow."

The moon has been considered to lack atmosphere because it presents a clean edge in eclipses, when sunlight is not disturbed or changed in passing it, as it would be if the moon had a perceptible atmosphere. It has been recently calculated by American astronomers that the moon's atmosphere must be less dense than one part in 1,750, as compared with that of the earth.

In substance, the moon is considered to be about identical with the earth, because it is usually held that the moon was once part of the earth, breaking away from it hundreds of millions or billions of years ago. The moon is supposed to have no atmosphere because it is not big enough to have a force of gravity sufficient to attach an atmosphere to itself. For instance, the earth's mass gives it a force sufficient to hold anything moving at a speed under six and nine-tenths miles a second.

The molecules of free hydrogen and helium are believed to attain a speed in excess of six and nine-tenths miles a second, thus overcoming the force of gravity and eventually escaping from the earth's atmosphere. Oxygen molecules move less rapidly, and combined oxygen and hydrogen molecules less rapidly, than six and nine-tenths miles, so that they are retained in the atmospheric envelope of the earth. On the other hand, the moon has not mass enough, according to theory to hold the gases which form our air.

Mars has barely enough mass to control the velocity of molecules of the air, but still has a very thin atmosphere, which has always been put forward, as in the case of the moon, as the strongest evidence against the existence of life.

In reply to this, the astronomer Flammarion has said that a fish would argue that no life could exist on earth because of the lack of density in the air. To argue on this ground, he said, that life could not exist on Mars was to argue like a fish, not like a philosopher.

In our accompanying illustration, we have tried to show graphically what Professor Pickering claims to have seen. The scene is laid in one of the craters of the moon, exposed to the full sun light at the height of the lunar day. Here we see tremendously high mushroom growth several hundred feet high. Due to the low gravitation on the moon—a 200 pound man on earth weighs only 31 pounds on the

(Continued on page 753)

## A Few January Articles

*The Man in the Moon—A Cave Man. By C. S. Corrigan, C. E.*

*Engineering for My Boy—How and Why of the Engineer's Profession By H. Winfield Secor*

*Baseball Scores by Wire—An Electrical Score Board that Shows Football and Baseball "Plays."*

*The Motorless Airplane; Is the Glider to Supplant the Motor-Driven Craft? By Stanley Yale Beach Ph. B.*

*Quartz—Its Relation to Man and its Place in Nature. By Dr Ernest Bade.*

*Why Our Winters are Warmer By Isabel M Lewis, M A., of the U. S. Naval Observatory*

*Buying a Second-Hand Car By Edna Purdy*

*How Plate Glass is Made. By Robert G Skerrett*

*How to Make a Microphotographic Camera, and Use it. Written by an Expert in Microphotography.*

*Fortunes from Flashlights—How a Simple Idea Made Millions of Dollars. By Charles Frederick Carter.*

*Ultra High Speed Atoms—And their Effects. By Rogers D. Rusk, M A*

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# Science in New Apartment House De Luxe

## A Wonder Apartment for the City Dweller, with Lakes, Tennis Courts and Sunken Gardens

IN Cleveland, Ohio, there is a remarkable apartment house built somewhat on the style of a modern hotel, which is the envy of all apartment dwellers, who have seen it. The cooking is done in a centralized kitchen for all the apartments, the soiled dishes are washed in one of the kitchen departments, and each apartment has an ice box supplied thru cooling pipes from the basement. The present illustration shows some of the features of this modern apartment house de luxe, and also some of the newest ideas suggested for a gigantic apartment dwelling, which it is proposed to build in New York City. The architects and engineers, who have designed this beautiful city dwelling, have thoroly worked out their plans so as to provide a very spacious court yard covering several city blocks, while the building itself has been designed to run around this spacious tract of land. In this way excellent ventilation and daylight for all the apartments is obtainable. The court yard, if so we may call this spacious enclosure, is arranged to contain tennis and squash courts, a lake suitable for boating in the summer and skating in the winter, shady walks with flowers, bushes, and shrubs, leading to a large sunken garden, besides a swimming pool, a baseball diamond, as well as sufficient area for small gardens so that Mr. and Mrs. Apartment Dweller may have fresh radishes and lettuce right out of the garden in season.

But the architectual features do not stop here because the present plans include a proposed moat or wall such as those surrounding the old feudal castles, with a canal or channel of water separating the street from the court yard.

### A Day in the Wonder Apartment of Tomorrow

You awake in the morning and find that considerable snow has fallen over night. Funny you think, that the room should be so comfortable and not freezing cold, but the automatic thermostat connected to the radiator hidden in the wall, has served to keep the room temperature up to a suitable point thru the night. There is no ice on the outer window or storm sash due to the fact that air at a suitable temperature constantly circulates between the two windows. The windows are also provided with an electric opening and closing device, which can be operated from the bedside by the pressure of a button. It is as quiet as if one were in a tomb yet one may sleep very peacefully without hearing any noises thru partitions, floors or ceilings, from adjacent apartments, thanks to the cork and felt linings between the floors, partitions, and walls, which absorb any sound which would otherwise be transmitted. Handy reading lamps are found on each bed, while a portable telephone which can be plugged into a receptacle by means of a flexible cord in any room of the apartment is found on a table between the beds.

Every five-room apartment has one bathroom, while eight to ten room apartments have two bathrooms. Hot and cold water is supplied to each bathroom, as well as iced and ozonated drinking water, which is therefore, thoroly germ-proof besides having a sparkle all its own. Of course all the usual electrical conveniences such as curling irons, et cetera, are provided in the bedroom, or these may be used in the bathroom, when plugged into receptacles provided for the purpose.

When we come to the dining room, we are agreeably surprised at the absence of cooking odors, always so noticeable in the average small size city apartment. An electric ozone generator fitted in the wall and covered by a small grill, has obliterated any odors. You step to the telephone in the hall, or perhaps you have already 'phoned from your bedroom upon arising, and order your breakfast from the central kitchen in the basement. At the appointed time your dumbwaiter alarm sounds and you pass thru the electrically operated swinging door into the kitchenette shown in the plan view of the apartment herewith. By pressing a button with your foot as you approach the swinging door from either side the door, operated by electro magnets under the floor, opens just ahead of you, so that the maid can carry a trayful of dishes without picking her way thru it, and possibly get a crack on the elbow that may cause her to drop the dishes.

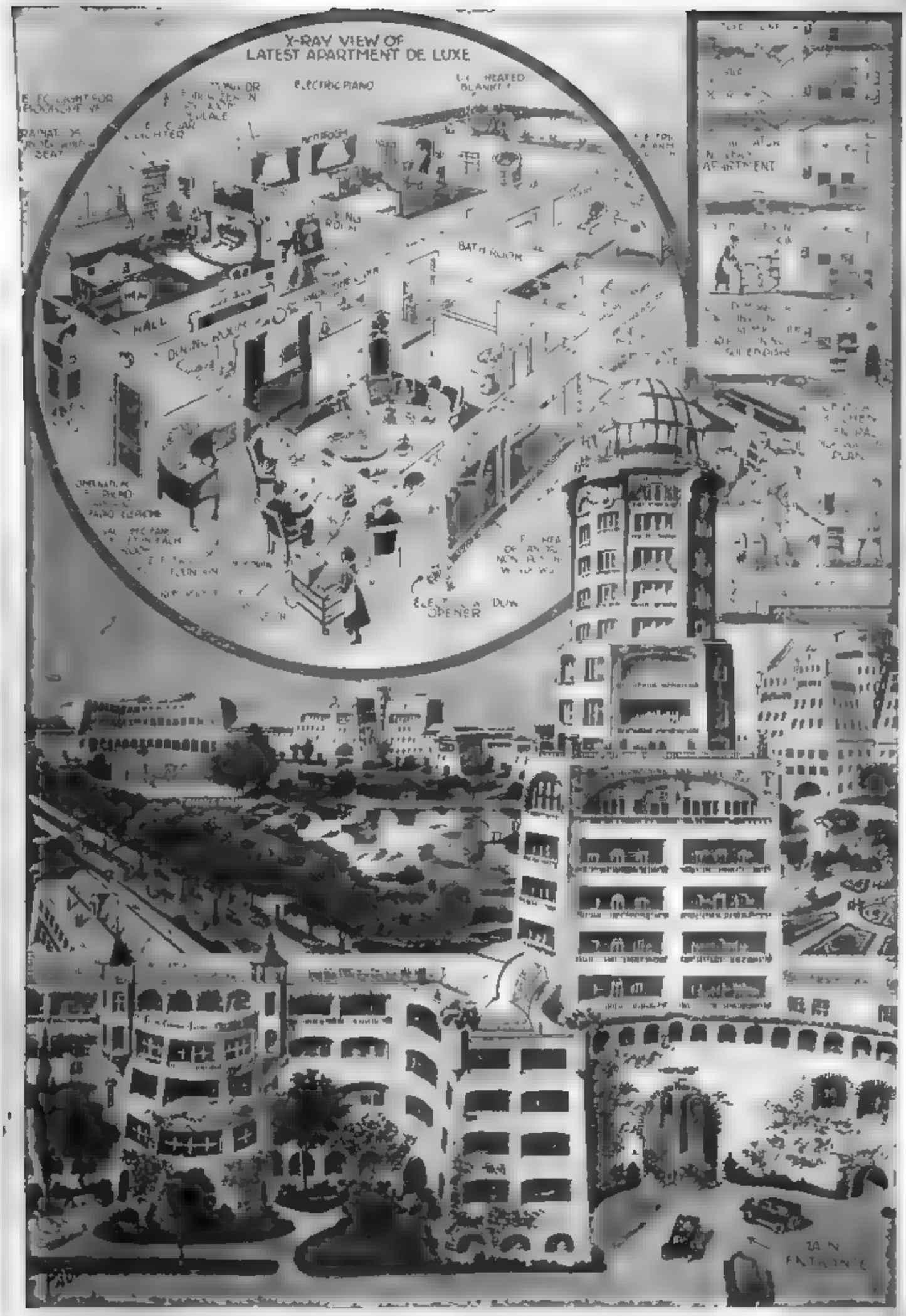
The dining room table is fitted with several electrical sockets into which may be plugged a coffee percolator, an electric hot dish, or waffle iron, etc. The victuals may be carried into the dining room, or else wheeled in on the specially devised tea wagon shown. After the meal, the soiled dishes are placed in a foot operated metal container containing a deodorant and these are then placed in the dumbwaiter and dispatched basementward, to be washed in the gigantic kitchen and dishwashing department provided for the several hundred families who make this apartment house their home.

One thing that tickles you all the way thru is the fact that the temperature is so even in all the rooms and halls thanks to the automatic thermostats which control the amount of heat distributed by the radiators. Another surprise, that impresses you, is that valves are provided on each radiator so that when the warm weather arrives you can close the steam valves and open the brine pipe valves, allowing the cooling brine solution to circulate thru the radiator instead of steam or hot water, which will keep the apartment at a prearranged and livable temperature on the hottest days. You also discover that the so called kitchenette contains a handy sink as well as hot and cold water and ice water besides. Set in the wall alongside of the dumbwaiter door is a nifty ice less refrigerator, so that you do not have to worry about the ice man coming around every day. A cooling worm made of pipe is all that you see and it is white with ice. Cooling brine supplied thru pipes from the basement refrigerating plant keep this worm cold at all times, and by placing a pan of water in one of the compartments, you may freeze a small cake of ice so as to provide cracked ice for drinks, table service etc. Bottles of ale, near beer and champagne can be kept cold in this refrigerator as well as fruit that you may want to keep from spoiling. When the maid who has charge of your section and floor of the apartment house arrives to clean the rooms, you expect to see her use an electric vacuum cleaner, but all she carries with her is a piece of rubber tube which she attaches to a pipe opening provided in the base board of each room. You learn later that a large vacuum cleaner plant installed in the engine room in the basement, keeps up a constant suction or vacuum thru pipes running to every room in this huge dwelling, so that rooms can be cleaned at any time and there is no dust or dirt to handle.

When noon arrives we hear a chime strike and perhaps wonder how the superintendent manages to keep all the clocks in the hundreds of apartments exactly right. Upon inquiry it develops that the clocks are electrically wound and corrected from a radio station on the roof of the dwelling. Moreover we are told that this radio station is equipped for transmitting as well as receiving messages, including the radio time signals sent out from the great Government station at Washington at 12:00 noon, and 10:00 p. m. at night.

In the evening after an excellent dinner cooked by expert chefs in the great kitchen below stairs, we adjourn to the living room or parlor. If we wish to play the piano we find that it is electrically operated, and that all we have to do is to manipulate the usual tempo and other control keys. Later we listen to a selection from the opera "Carmen" played on the electrically operated phonograph, and tiring of the records at hand and wishing to learn the latest news of the day (even fresher than that gleaned by reading the 15th edition of the Evening Globe, while dashing homeward in one of the airplanes belonging to the fleet operated by the apartment house management) we switch on the Magnavox radio loud talker which act has caused a signal to drop on the switchboard in the radio room atop the building, and we are immediately switched on to the powerful audion amplifier receiving set and we hear the latest news, interspersed with snappy jokes and songs via radio telephone from the powerful radiofone station W J Z located at Newark, N. J.

The apartment house hospital is always at our beck and call in the event that someone in the family is taken ill or receives an injury. Physicians and surgeons are constantly in attendance as well as trained nurses. The hospital is equipt with the very latest type of X ray machine by means of which instantaneous photographs can be taken thru the thickest part of the body and by means of this ultra powerful high voltage X ray apparatus, treatment can be given for cancer and similar ailments which require X ray therapy. The hospital laboratory also contains among other up-to-date equipment, a powerful radium outfit, whereby cancer and similar afflictions can be given the proper treatment. Convalescents find the roof garden and sun parlor just like heaven with fragrant flowers, and as much fresh air as they may need, the weaker persons taking their sun bath under glass roofs, while the stronger ones may refresh themselves in the open air roof garden.


X-RAY VIEW OF
LATEST APARTMENT DE LUXE
ELECTRIC PIANO
HEATED
BLANKET
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APARTMENT
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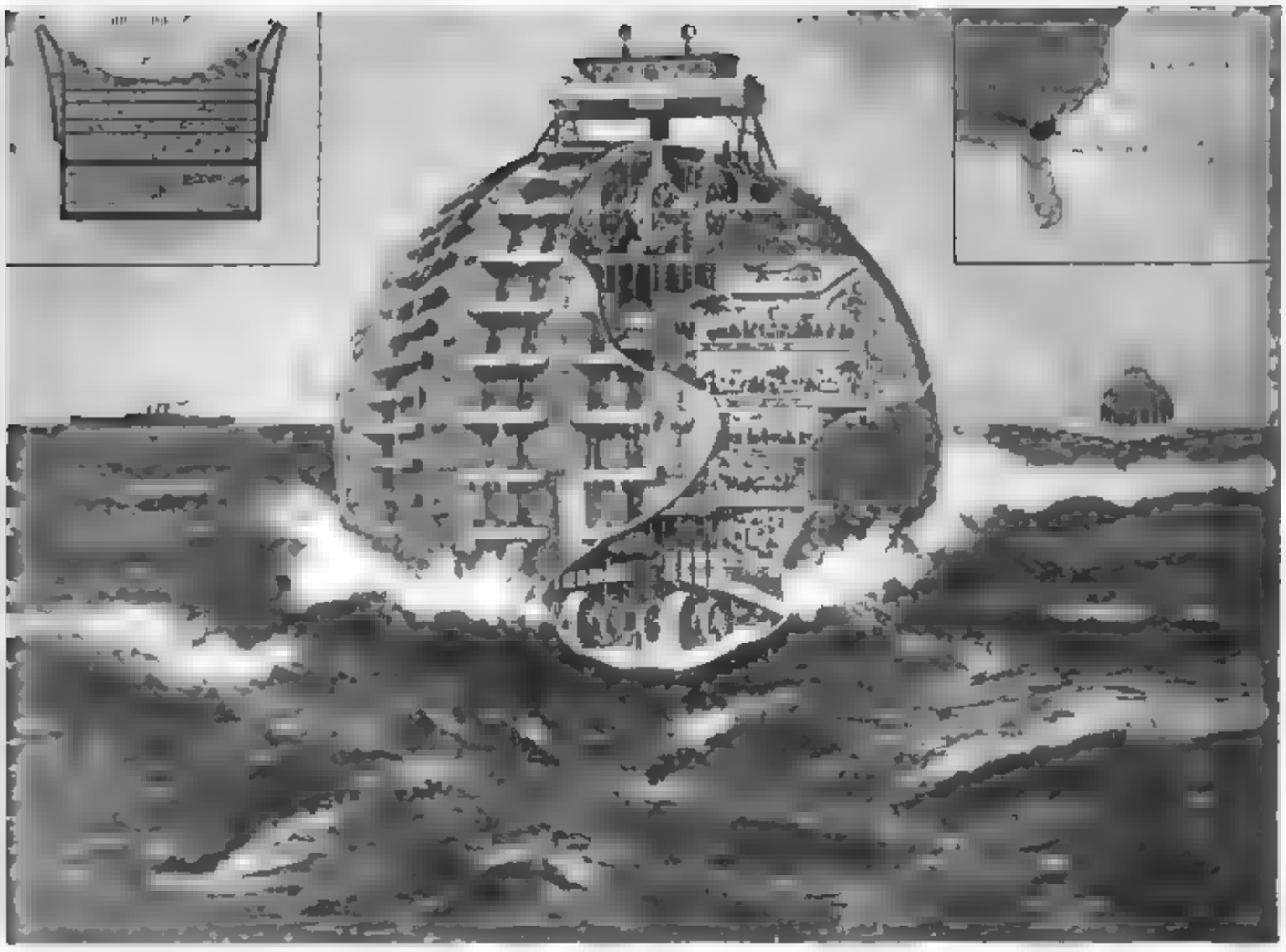

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The Latest Idea in Ocean and Land-going Ships—the "Ball-Rotor." It Spins Along Its Course, or Rather Its Paddle-like Treads Do; the Main Body of the Vessel Remaining Practically Stationary. Special Tracks or Roads are Provided on Land, the "Ball-Rotor" Moving Along Like a Tank, Such as Used in the World War. Internal Combustion Engines Drive the Moving Belts Carrying the Paddles, by Means of Chains and Gears, or Else a Dynamo-motor Electric Drive System Can be Utilized.

# The Ball-Rotor—It Travels O'er Land and Sea

THE gigantic rolling ball in the form of a ship capable of speeding along over land and water here illustrated, is called by its inventors, Messrs. Larson & Ross, the Land and Sea Ball-rotor. This monster passenger and freight carrier is designed to be built on a large scale, at least 200 ft. in diameter, which also means 200 ft. or more high. It is provided with four moving belts or treads suitably provided with blades, and these belts act in the same way as those on the well-known tank or caterpillar tractor. The main part of the Ball-rotor, in which the passenger and cargo compartments as well as the engine room are located, do not revolve but remain practically stationary, owing to the peculiar design of the machine. The center of gravity of the Ball-rotor is kept as low as possible, and this factor is favored by placing the cargo as well as the engine room with its heavy engines in the lowermost holds. Water-ballast tanks are provided also on either side of the Ball-rotor, so that in case of an accident or for other purposes, water-ballast may be taken into or released from one or both of these tanks.

The moving belts carrying the blades around the perifery of the ball-shaped vessel, are driven by chain belts directly from the engines, or as shown in another design, the engines may drive dynamos, and electric current obtained from the dynamos operates electric motors secured to the driving gear at the top of the craft, as shown in the illustration.

At this point it is interesting to note how the designers of the Ball-rotor have arranged for turning the craft even at sharp angles. As long as the revolving belts and their attached blades are revolving at the same speed in one direction or the other, the craft will proceed straight ahead on its course. To cause the craft to turn one way or the other, either the right or left hand moving belts are caused to be reversed, either by means of a suitable gear-change or else by reversing the connections to the electric driving motor on that particular side. Of course all such control of the propelling machinery is effected from the officers' bridge and pilot house surmounting the top of the craft.

Wireless telephone and telegraph messages are handled to and from the craft by a wireless station located on one of the upper decks or holds, whichever you want to call it, and the transmission and reception of messages is designed to be taken care of by means of a concentrated self-contained aerial, no wires being necessary on the outside of the craft.

The inventors of the Ball-rotor have designs all worked out for a road to be built over land, this road being about 70 ft. wide and 14 ft. deep. It is designed to be built of reinforced concrete, having a ratio of 1-2-4. This road is calculated to support a load of 100,000 tons with a factor of safety of 20, that is the working load of 100,000 tons represents but 1/20th of the total load which the road-bed will withstand. When preparing to travel over land along a concrete road-bed of the type shown in the illustration, the blades used for propulsion thru the water are feathered or released by suitable gear, so as to form flat feet like those on a caterpillar tractor.

An elevator, or in fact several of them will be required; such are provided for in the designs by Messrs. Larson and Ross for carrying passengers to and from different decks. The freight cargo including passengers' baggage is loaded thru steel doors opening on the outside of the vessel. It is intended by the inventors that the ballast chambers shall serve as safety air chambers ordinarily.

Its design provides for quick maneuvering when in the water, and no doubt it will be favorably considered by naval experts in the event of another war. The Ball-rotor design was suggested and explained to our War Department some time ago, and if they reject it, Great Britain and France are ready to examine it, with a view to its adoption in naval as well as in the Merchant Marine Service.

Volume IX
Whole No. 105

Science and Invention

H. GERNSBACK, - EDITOR
H. WINFIELD SECOR, - ASSOCIATE EDITOR
T. O'CONOR SLOANE, Ph.D. - ASSOCIATE EDITOR

JANUARY
1922
No. 9

# Baseball "Movie" Scoreboard

MOVING pictures flashed upon a screen without a moving picture projector. That would make a strange sub-title. Nevertheless such is the case and in New York thousands of people daily witness the attempts of Mr. George S. Coleman and his assistants to mystify his audiences with actual motion pictures of the "World Series" baseball games conducted at the Polo Grounds. Each move of the players was telegraphed to the 12th Regiment Armory where this exhibition was conducted, and in turn, the instant it was received, it was flashed upon a screen about 12 ft. high. Viewing the game from the audience's point of view, we see a miniature replica of the baseball diamond. The pitcher is winding up. He makes a vigorous swing and the ball passes to the catcher. The outfielder is jumping up and down. With rapid pauses, the ball is sent around to the bases and out to the center field and back again. Now an umpire walks over to take his place alongside of first base. Shortly thereafter the other umpires take their respective positions. The order is given to play ball and a player walks into the scene. He stoops down to pick up the bat and steps to the plate, the pitcher swings and the ball flies to the catcher. The umpire signals ball one. The ball wends its way over the plate again, strike one is signaled. Again the round sphere is tost. The batter makes a vigorous swing, a two base hit is the result. A second player steps to the bat, he is struck out. A third player—the man on second steals to third—this third player is struck out. The fourth one steps forward, he manages to reach first base, but the man on third could not get home, remaining safe on third. Still another player comes up to sling at the ball while word is past thru the audience, "Babe Ruth up." The ball, a beautiful curve, winds its way over the plate. Its gyrations are too wonderful to be true. Babe steps forward; the bat in his hands swings and a moment later the ball again enters the field of vision. Meanwhile Babe has completely circumnavigated the course allotted him and two runs are scored. He comes near home plate and one wonderful slide takes place whence he emerges from a cloud of dust and walks off the diamond.

The "World Series" Baseball Games Were Reproduced, Play by Play at a New York Armory by Means of This Ingenious Lamp Board and Transparent Screen. The Plays Were Received by Telegraph. The Movements of the Players as Well as the Batted Ball Were All Faithfully Duplicated.

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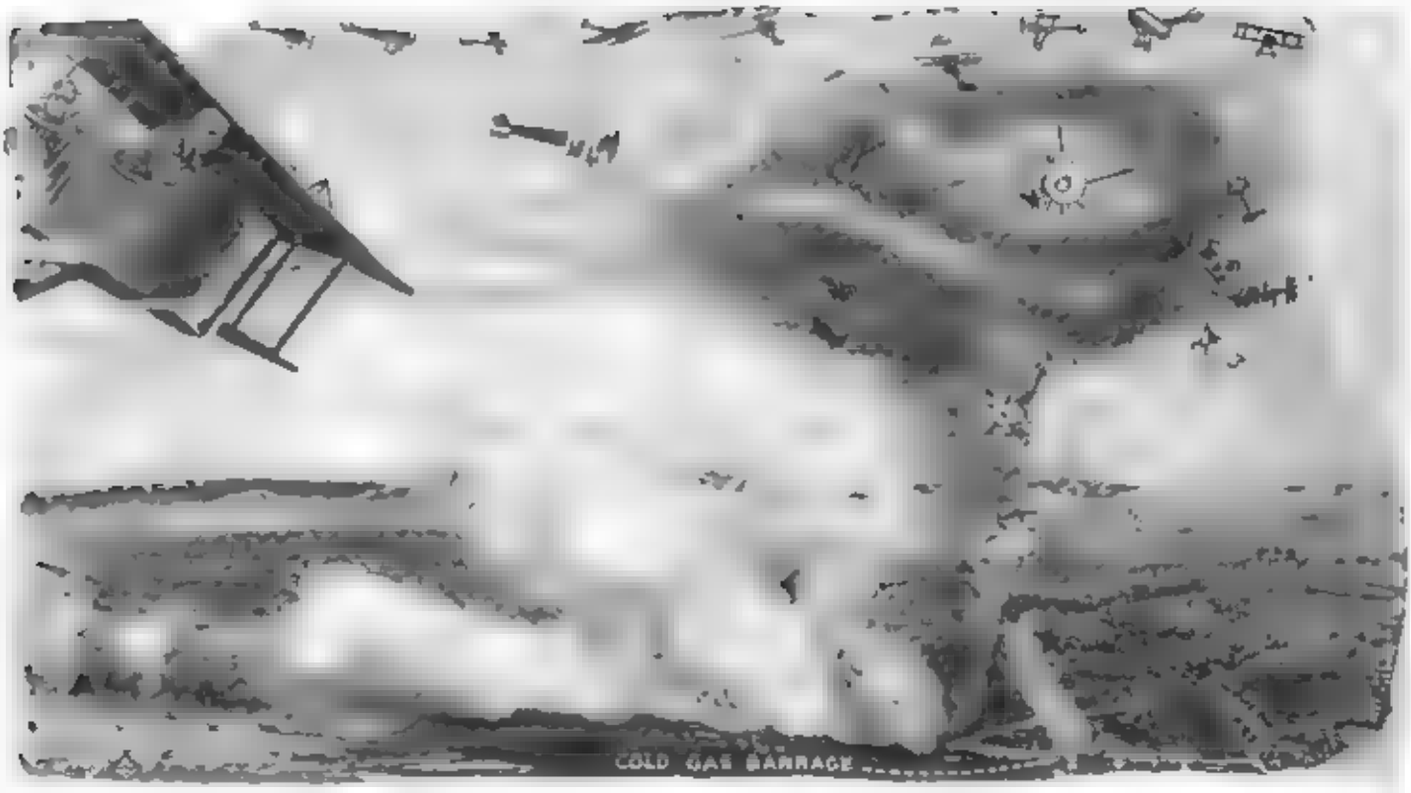
A word or two in regard to how this device functions. In back of the screen on an exceptionally large framework are arranged 600 electric light bulbs of the concentrated filament type. These are mounted in back of a similar number of

(Continued on page 850)




**Must We Go on Forever, Paralleling Cyclones or Tornadoes to Proceed on Their Devastating Way Without Attempting to Thwart Them? Mr. Corrigan, the Civil Engineer Who Wrote the Accompanying Article, Has Had Interesting First-Hand Experience in Breaking up a "Twister" in the South-Western Part of the United States, with the Aid of Dynamite, and He Here Presents a Plan for Breaking up the Whirling Column of Air Which is the Source of the Damage Caused by Tornadoes, by Dropping High Explosive Bombs into the Whirling Air Column or Its Vicinity from Airplanes, as Well as Firing Explosive Bombs from Mortars Mounted on Motor Trucks.**

# How to Prevent Gulf Storms and Tornadoes

## By C. S. CORRIGAN, C.E.

SOME years ago while building a railroad in the Southwest, I stored considerable dynamite in a log corn-crib; next day the rancher told me that the crib had been picked up and thrown around by tornadoes so often, that it was now three miles from where he had built it. I had often thought I would like to shoot a torrado all to smithereens; so I rigged up a trigger that would explode a charge of dynamite when jerked by a long rope, one end of which I tied to a stake in the ground and the other end was fastened to the crib. Two weeks later while at supper in camp half a mile down the valley, we heard an ominous roar, someone hollered "Twister coming," then while the men ran in all directions I stood and watched the dark cloud, with its black arm swaying and writhing, pick up everything as it rapidly advanced, and saw it pick up the corn crib and suck it toward the center of the storm. The rope jerked the stake up and there was a tremendous explosion, the roar ceased, there was a deluge of rain, but no tornado and very little wind, and in a few minutes the sky was clear again. The explosion in the vortex of the tornado had broken and disturbed the suction and centrifugal forces so much that they were unable to keep on lifting the heavy load of rain water which gave the cloud its black appearance, the rain falling cooled the air so the storm could not form again. I concluded then and still believe that all tornadoes can be destroyed like that one was.

I soon found that all storms are caused by areas of excessively hot air at the surface being slightly disturbed by what aviators call, *holes in the atmosphere*, spots where the air is less heavy than at other places, allowing the hot surface air to ascend. On reaching a lighter atmosphere it expands, thereby loosing heat, forming water vapor and contracting, so that it sucks more hot air up, which goes thru the same process, until the hole is filled with air colder and heavier than the surrounding atmosphere. No longer able to ascend the momentum of the ascending air forces it out and over the surrounding air, like an overflow, thereby making it heavier and adding pressure to the air below, so it is more easily sucked toward the center and upward. At first there is no rotary motion and the velocity very small, rotation starts and increases until tremendous centrifugal and suction forces are sometimes developed.

From this you see that it is necessary to have nearly a dead calm, both at the surface and in the upper atmosphere when a storm starts. If on a hot calm day you see clouds called *thundercaps*, forming one after another you know an upper wind is blowing the tops off what might otherwise develop into tornadoes. Altho all storms start at the surface and are constantly fed by hot air from the surface, there is nothing about any of them that you can see until the ascending air expands, cools, condenses its moisture and forms a cloud; once formed a tornado cloud keeps getting lower and darker, then reaches lower and lower with a dark arm that at last reaches the surface; this arm is the vortex of the cloud heavy with drops of rain. It takes that shape because in the vortex the suction and centrifugal force cause the air being sucked up, to expand, cool and condense its moisture while near the ground, the lifting power of the wind prevents this rain from falling there but carries it with dirt and other things to the highest parts of the cloud, where it spreads out and falls as rain or hail at either side or behind the vortex. In a large vortex the centrifugal force is sometimes so strong that it overpowers suction, and throws everything away from the center, making a clear place which the ancients believed was the all-seeing eye of God, as he rode the storm.

Tornadoes vary in size, some having funnels or arms, only a few feet across, others may be a hundred yards in diameter. They advance from 6 to 100 miles per hour the average being about 20 miles per hour, slight differences in pressure of side winds often cause them to nearly stand still, then to change their course and dart forward, their general direction is always S W to N E. They may travel as much as 100 miles or as little as ¼ of a mile, the average distance being 25 miles. Most of them are stopt by changes in atmospheric temperature such as colder air currents on the ground, but more often in the higher atmosphere, sometimes after going up one side of a hill the tornado is prevented from going down the other side by an up-hill wind, sometimes it may be stopt by huge oil tanks or buildings, which the great whirlwind cannot destroy or lift, the part of the arm that goes over the top being too high off the ground to reach down immediately. When the suction stops for a moment or cold air causes rain to fall in front of it, it turns into a cloud-burst which soon is exhausted. There are more tornadoes (about 150 a year) in our Southwestern and Central States than any place else in the world, and many people are afraid to live there.

Our great Gulf Storms usually form in the Caribbean Sea and enter the Gulf thru the Yucatan Channel, they are simply tornadoes formed at sea, and having nothing to stop them assume large proportions and travel thousands of miles. Their chief characteristics are the immense columns of water continually being sucked up, and the great tidal wave, often 10 to 15 feet high, which is drawn together ahead of them. If they hit the coast at high ground, the great column of water is lifted, forms a vacuum at its base which overcomes the lifting suction, it falls and breaks up the vortex, the storm turns into a deluge of salt water rain and soon plays out. But most of the Gulf coast is low, so more often the great tidal wave spreads out over the prairies so far that the water supply to the

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**Some Years Ago Mr. Corrigan Had Some Interesting Experiences in the Gulf of Mexico, and He Relates How He Has Seen Dozens of Gulf Storms, Which Resemble Tornadoes on Land, Start Up and Develop. Ships Could Approach Quite Close to the Towering Water Spouts Created by These Storms, and Fire Explosive Bombs into the Whirling Water and Air Columns, so as to Shatter It, He Says. Bombing Planes, Directed by Radio Either from a Land Radio Compass Station or from Scout Planes Could also be Used, Mr. Corrigan Suggested, in Breaking up These Storms.**

central column is slowly diminished and it gradually changes from a water to a land storm and advances until stopt by atmospheric conditions. Most of the damage by Gulf storms is on account of this high tide wave inundating the land, washing away and destroying buildings and helping the waves and wind drive large vessels far up on the shore, as in the recent storm at Tampa.

Long before a large tornado or hurricane can be seen or heard, its suction has reduced the air pressure far in front of it so much that it can be felt, and this accounts for the fact that any barometer will foretell the coming of such a storm. The air pressure sometimes gets as low as 11 lbs. per sq. inch near the center of a storm, normal pressure being 14.7, constituting a difference in pressure of 633 lbs. in each square foot. When people see a storm coming and close the doors and windows, they are only helping to wreck the house as the air inside leaks out as fast as it can. If the storm advances very fast and reaches the house while there is a two pound difference in pressure, the air inside presses 288 lbs. per sq. ft. outward against the walls and roof, the shingles fly off, the walls fall out, the house just flies to pieces, and the tornado only has to pick up the pieces, while if the house had been left open it might not have been damaged. It is this lack of air pressure, that draws the great tidal waves together, miles ahead of the wind of a Gulf storm.

Each hot day in our southwestern states hundreds of small tornadoes or whirlwinds form under favorable local conditions, but general conditions and winds in the higher atmosphere not being favorable they end in a few minutes. The same is true of water spouts on the Gulf and Gulf coast bays. One clear afternoon from the top deck of a dredge boat in Galveston Channel I saw 18 in 4 hours, all that reached land were destroyed when their column of water dropt, none lasted more than half an hour; one of them came in from the Gulf on a direct line towards the dredge, and was closely watched by more than 20 men. When it reached the beach the column of water was lifted about 10 ft. as we saw clear space beneath it, then it all tumbled with great force. Visiting the beach afterward I found that a small bay had been washed out 50 ft. in from the shore. When the cloud which accompanied the spout was over the dredge boat there was a heavy rain, and the water caught in pans was 70% as salty as sea water, showing that that proportion had been sucked up out of the Gulf, the 30% having been condensed from the air sucked in around it. On such an afternoon there are also numbers of little thunder showers, when a spout runs into or crosses just behind one of these, the spout drops and is destroyed by the cooler air.

*POSSIBLY you have experienced the terrors of a tornado or hurricane, especially some of those which frequent the southwestern section of the United States in the summer months, and when mere man comes forward with an idea for subjugating the powers of King Storm, you may feel like laughing at him. After reading Mr. Corrigan's article, we feel certain that you will see that he has incorporated some good sound logic in the arguments set forth. Mr. Corrigan is not talking entirely from a theoretical viewpoint in the accompanying article, for he has had a good deal of experience in all parts of the world, particularly sections frequented by tornadoes and gulf storms.*

*Next month we will have the pleasure of presenting a very original and highly interesting article by Mr. Corrigan,—"Is the Moon Inhabited?"*

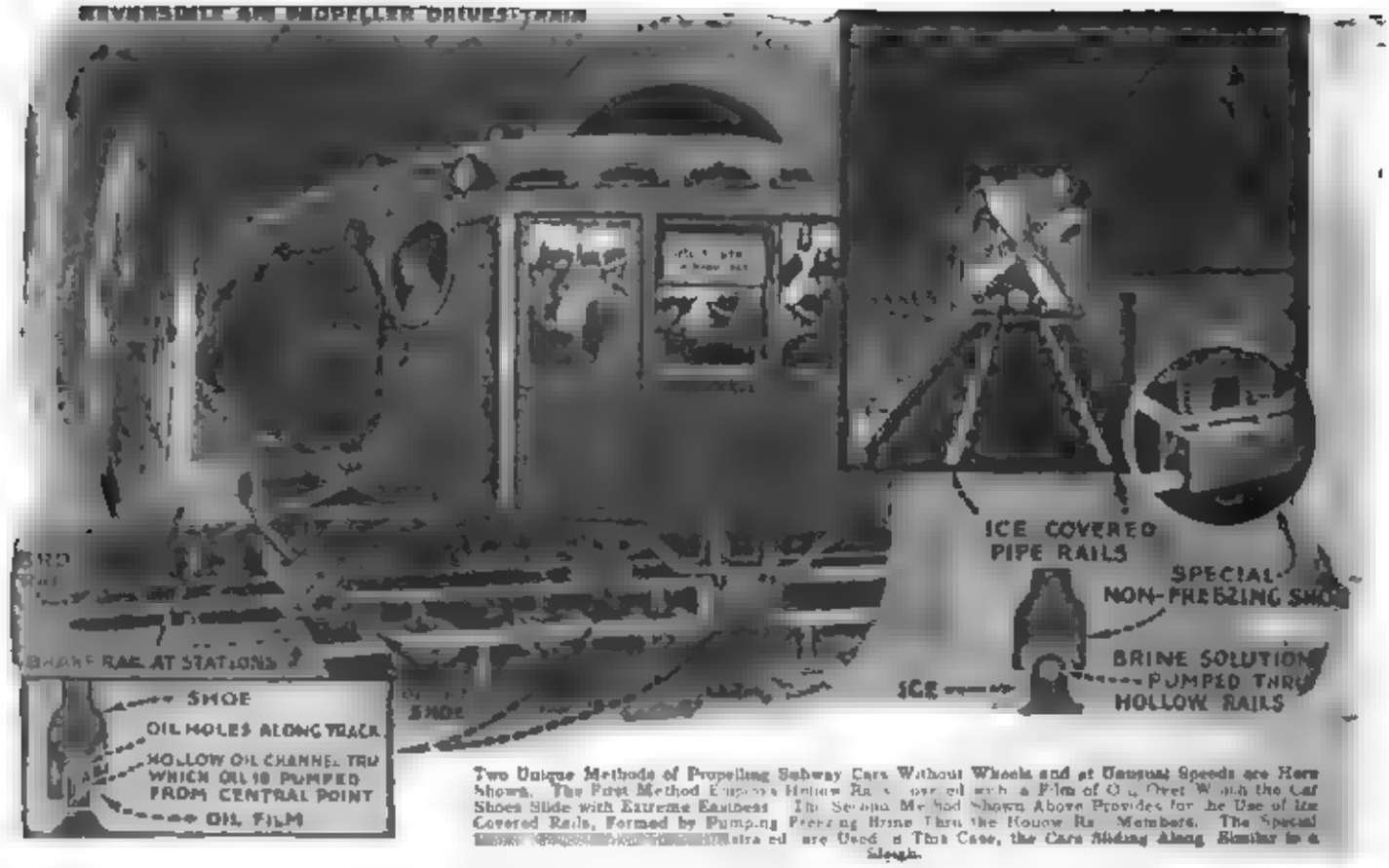
Now from what little I have said about storms it will be seen that of the thousands that form, nearly all are destroyed by Nature before they get large enough to do any real damage, that a disturbance of the vortex or the cooling of the air in front are the weapons she uses to destroy them all. The simplest and cheapest way man can follow Nature's instruction on a large enough scale to destroy large storms would be by disturbing the vortex with explosive bombs.

To do this on land I suggest airplane patrol stations, established where the most tornadoes form, just as we have fire engine houses in cities, I would have automatic wireless tornado alarm boxes similar to fire alarm boxes, scattered every few miles at farm houses. Any person seeing a *twister* would break the glass and the number would ring in by wireless. When received at the station airplanes would start out in its direction. Being a dark cloud in an otherwise clear sky, it could be easily located and time-fuse bombs could be dropt into its vortex. Fast motor cars with high angle mortar guns to throw time-fuse bombs into the vortex could also be used. The actual vortex not being obscured by a cloud the chauffeur could see at once if the first bomb was ill timed and the second would be sure to destroy the storm. In a city where bombs might do damage a cold gas-barrage could be spread in front of a tornado by releasing enough of the proper kind of gas, the cold air and gas being sucked up and expanded would condense the moisture and make it hail or rain in front of the vortex and so destroy it.

Ranchers could protect their dwellings by stationing bombs attached to air bags in the direction from which storms usually came, these could be set so that when sucked up into the vortex of a storm they would explode.

Gulf Storms could be entirely eliminated by seaplanes attached to mother ships, cruising in the Caribbean Sea and Yucatan Channel, bombing and destroying all water spouts as old battle-ships were recently destroyed on the Atlantic coast. If a big storm should get into the Gulf, a fast torpedo boat provided with air bags to which bombs were attached, could head right into the storm until the vortex could be seen, say within half a mile of it, then fill and release the bags; when sucked into the vortex the bombs would explode and destroy it.

After a few years' practice and study of storm conditions, storm prevention would be a great deal more efficient than fire prevention, because to destroy storms in certain sections, the conditions would always be the same, while in fighting fire there are many other things, such as falling walls and explosions to be guarded against.




Two Unique Methods of Propelling Subway Cars Without Wheels and at Unusual Speeds are Here Shown. The First Method Employs Hollow Rails Covered with a Film of Oil, Over Which the Car Shoes Slide with Extreme Easiness. The Second Method Shown Above Provides for the Use of Ice Covered Rails, Formed by Pumping Freezing Brine Thru the Hollow Rail Members. The Special [illegible] are Used in This Case, the Cars Sliding Along Similar to a Sleigh.

# Wheel-Less Subways of Tomorrow

WE are so used to seeing and riding in subway and other trains provided with wheels, that it is a little difficult perhaps to imagine a subway train of tomorrow speeding along at a 50 to 60 mile an hour clip on sleigh runners. This idea of providing the cars with runners or shoes designed to rest on oiled or snow covered tracks, as shown in the accompanying illustration, is the more easily reconciled in our minds perhaps, as compared to the old established idea of revolving wheels, when we stop to think of the roller coasters and scenic railways at our pleasure resorts. These cars slide on greased rails like sleighs and they travel at very high speed and also very economically.

There are several ways in which the cars on such a transportation system could be propelled. One of the methods available is shown in the illustration, and involves the use of an air-screw or propeller like that employed on the modern airplane. This propeller could be placed at the front or rear of the train, pulling it along if in front, and pushing it if mounted in the rear. The propeller could be driven by a powerful electric motor deriving its necessary current from a third rail and contact shoe secured to the side of the car in the usual fashion. Such air propelled railway cars are being used in Germany at the present time, use being made of some of the airplane engines scrapt from the War stock.

By making the propeller reversible with regard to the pitch of the blades, the car or train could be brought to a stop in very quick fashion, the motorman reversing the pitch of the blades, while the propeller was still revolving, resulting in the thrust being reversed, and thus causing the train to come to a stop. At stations it would be desirable undoubtedly to provide a braking rail and suitable brake shoes could be projected from the sides of the cars to make contact with this rail, these shoes being electro-magnetically or electro-pneumatically operated by the motorman.

An English engineer, Capt. H. G. Norrington, is a strong advocate of the "sleigh

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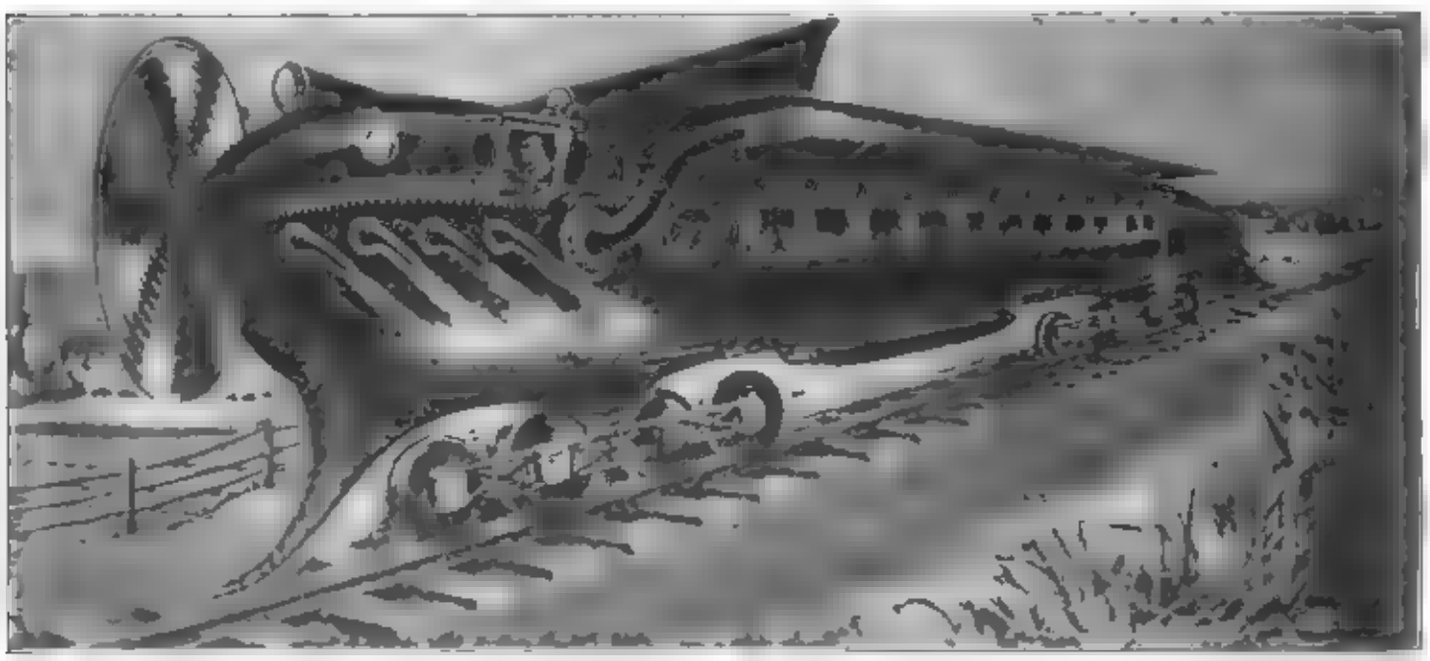


Another Idea in Railway Propulsion is the Air Propelled Monorail System Here Illustrated. The Car is Maintained in a Vertical Position by Virtue of the Stabilizing Wings and Rudders, as Well as by the Action of Two Powerful Jets of Air Shot Upward Under the Wings on Either Side.

# The Vibrator of Death

## By HAROLD F. RICHARDS, Ph.D.

ELON HOPKINS cast me a sidelong twinkle as Flocon came into our room at the Hotel Mondain, suggestive of a previous conjecture of his that had struck the truth. Only one who had frequently seen the Chief of the *Service de la Sûreté* could have read in his impassive countenance that at last he had found a pool too deep. Once before I had noted that general darkness on his face, [illegible] features of a bust, so I let fall the lid of my steamer trunk, it was now quite clear that the four-ten would leave without us. Flocon plumped his fat body down upon the trunk, and his moustache twitched nervously as he addressed Elon.

"Hopkins, you've got to help us," he [illegible] abruptly. "We can't locate the source of the radical propaganda that is tying up the country, and Camproger said a week ago that I'd have to get either action or help. I guess it's the latter."

Elon's blue eyes twinkled, but his [illegible] he queried [illegible] his pipe.

"Nothing to speak of," replied Flocon smoothly. "Three weeks ago the shipbuilders struck at Cherbourg, and two days later, the potters at Limoges. Then, in rapid succession, the principal industries at Nantes, Bordeaux and Lille, Rouen, Rennes, Angers and Tours are tied up tighter than a drum. But the strange feature of the situation is that the workers gave no indications of dissatisfaction until this internally [illegible] propaganda began to flood the country. We have a secret [illegible] leaflets in [illegible] for they've been waxing positively revolutionary, but we can't find the focus of infection. Camproger thinks it's a [illegible] of Gaudet, as he [illegible] Gaudet for dove at a [illegible] off the gat's tooth. We've tried to trace his movements but my best men lose him."

"He's the leader of the Left, isn't he?" asked Elon.

"Yes. He expected to be the next premier, but the work of the Conservatives at the peace convention was too good to be overlooked, and Camproger got in. Since then Gaudet has been strangely quiet, and the Conservatives had things all their own way until these strikes began. In the last three weeks the confidence majority has shrunk from 497 to 28, and Camproger told me this morning that his cabinet will fall in two weeks, if we can't stamp out this propaganda."

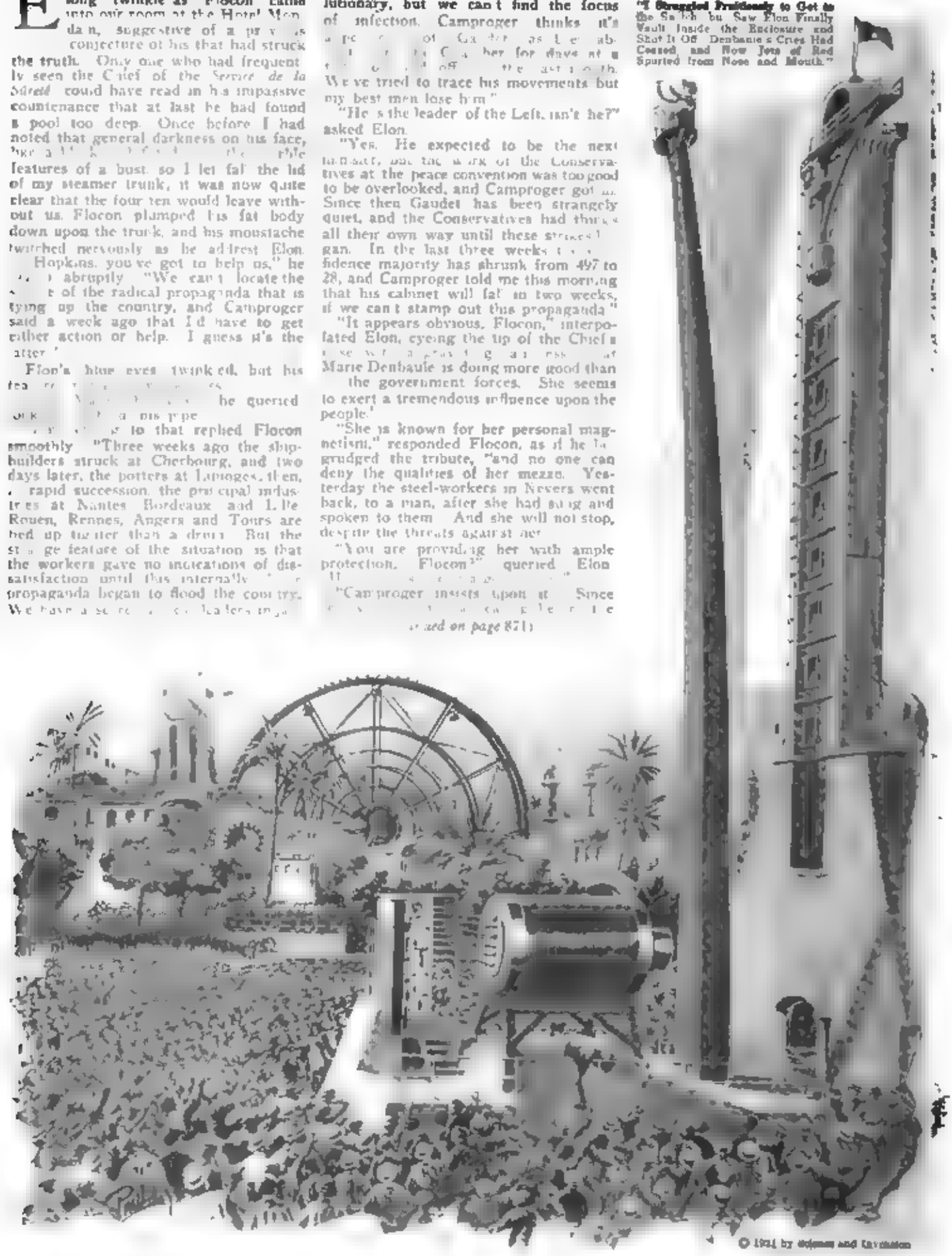
"It appears obvious, Flocon," interpolated Elon, eyeing the tip of the Chief's [illegible] that Marie Denbaule is doing more good than the government forces. She seems to exert a tremendous influence upon the people."

"She is known for her personal magnetism," responded Flocon, as if he begrudged the tribute, "and no one can deny the qualities of her mezzo. Yesterday the steel-workers in Nevers went back, to a man, after she had sung and spoken to them. And she will not stop, despite the threats against her."

"You are providing her with ample protection, Flocon?" queried Elon [illegible]

"Camproger insists upon it. Since [illegible]

(Continued on page 871)



"I Struggled Fruitlessly to Get to the Switch, but Saw Elon Finally Vault Inside the Enclosure and Shot It Off. Denbaule's Cries Had Ceased, and Now Jets of Red Spurted from Nose and Mouth."

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H GERNSBACK,- EDITOR
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1922
No. 11

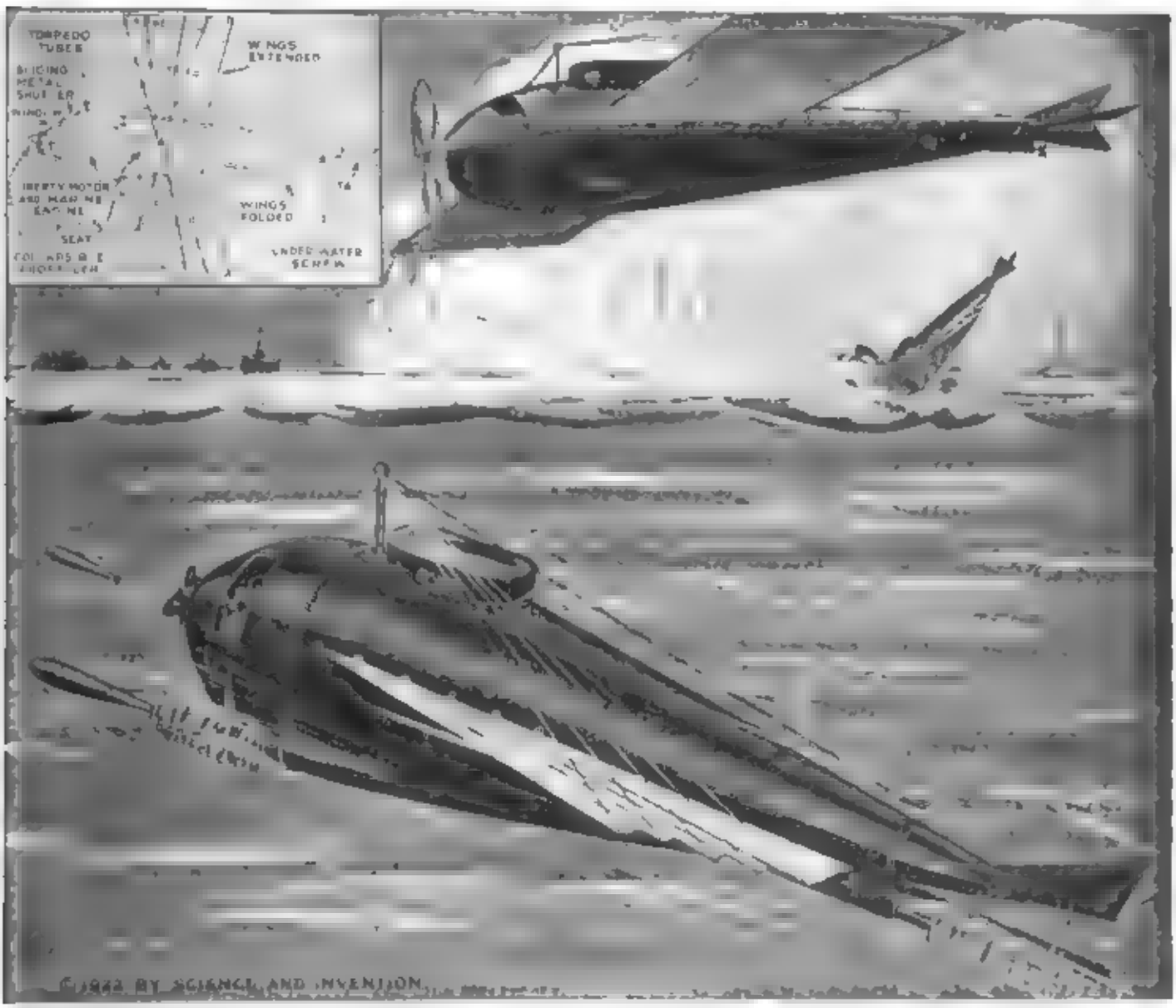
# A Combination Airplane and Submarine

## By EARL C. McCAIN

THIS combination airplane and submarine, invented by three men of Pueblo, Colo., may have the effect of revolutionizing modern warfare. This device combines the fundamental principles of both. Patent Office officials have written the inventor that the machine is the first of its kind ever received at the office, and shows real practicability, patents are now pending on this machine.

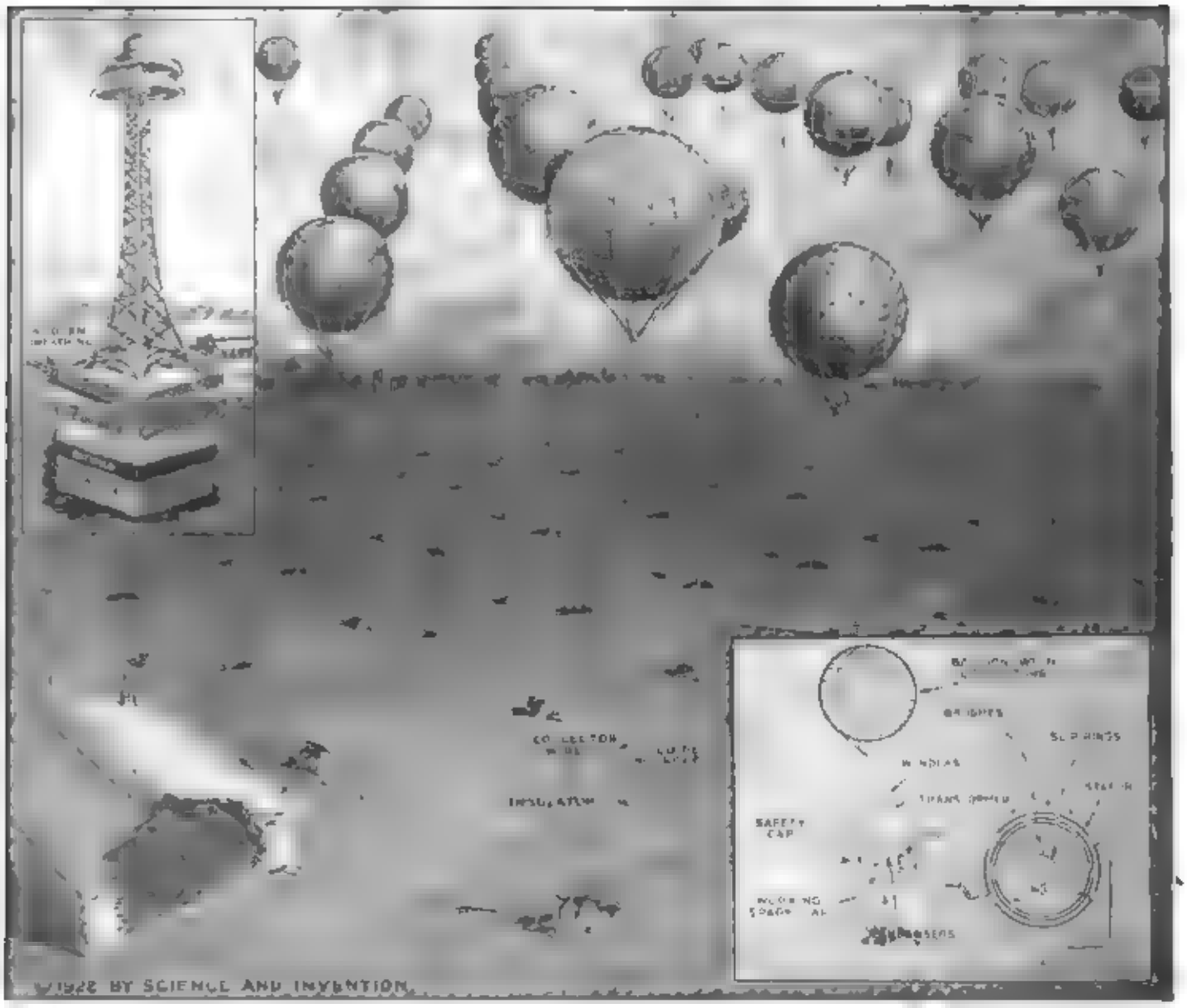
The machine is only twenty feet in length, tho the wing spread, when being used as an airplane, is thirty feet. The main secrets of the machine are collapsible wings and a folding propeller that fold up as the machine strikes the water to become a submarine. In the air the machine is driven by an ordinary twelve-cylinder Liberty motor, but under water,

(*Continued on page 1067*)




The Latest Invention in Air and Water Craft is the Combined "Airplane-Submarine" Here Illustrated. This Machine Should Prove of Considerable Use in Military and Naval Maneuvers, Owing to its Great Flexibility. This Craft can Fly Thru the Air, Gradually Descend Toward the Water, and Folding its Wings, Dive Beneath the Waves and Speed Along as a Submarine. It is Designed to Have at Least Two Torpedo Tubes for Firing Torpedoes at Ships, or These Might Be Dropt as Aerial Bombs when the Craft is Flying Thru the Air.

# Power from the Air



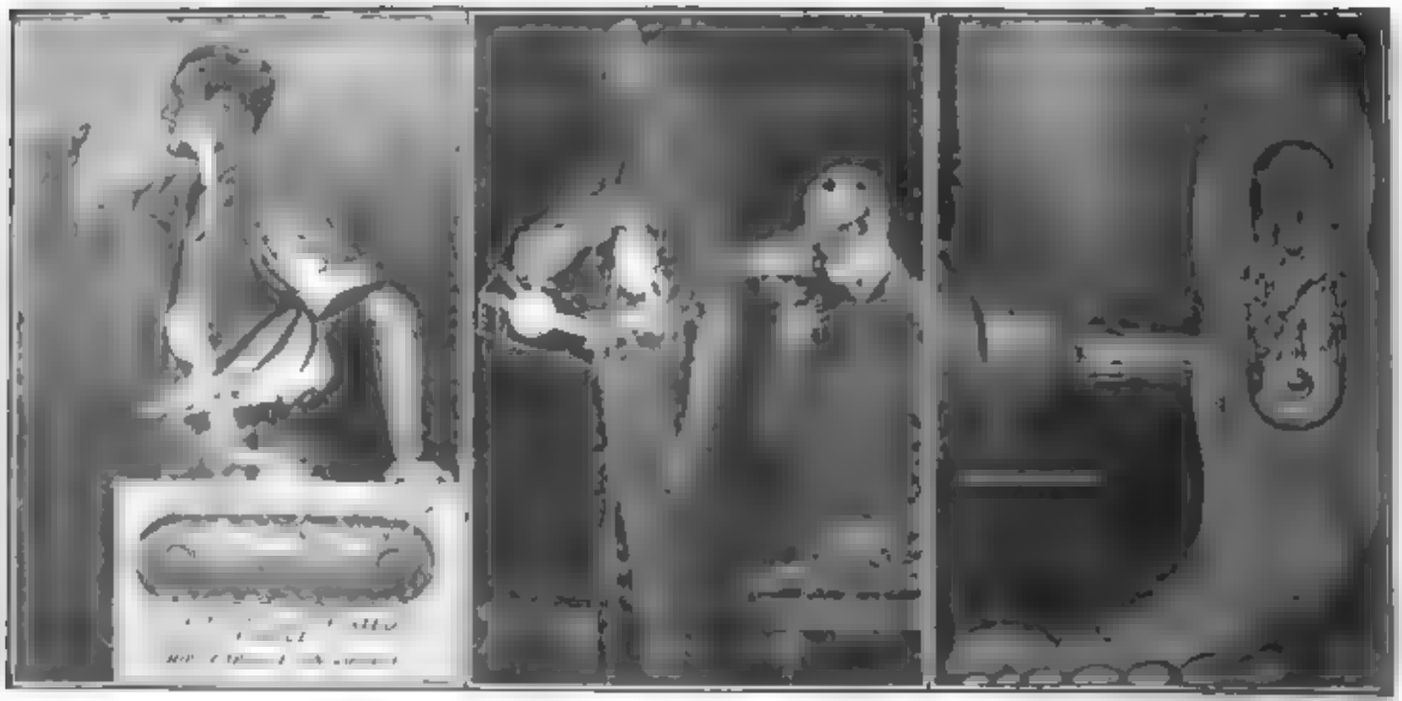

**For Many Years Electrical Engineers Have Endeavored to Devise Some Means Whereby It Would Become Possible to Utilize the Free Electrical Energy Ever Present in the Atmosphere, But They Were Not Successful, as Every Now and Then an Extra Heavy Surge of Static Current Would Rush Down the Elevated Conductor and Endanger the Lives of the Experimenters, or Else Destroy the Apparatus Connected With It. A German Engineer Has, However, Devised the Somewhat Elaborate Scheme Here Shown in Brief, and He Has Succeeded, at Least as His Report States, in Safely Extracting Several Kilowatts of Electrical Power from the Atmosphere With Metallic Surfaced Balloons, Elevated to a Height of Only 1,000 Feet.**

WE have previously treated of the extraction of electrical energy from the atmosphere. The difference of electric potential in different parts of the atmosphere, and the difference between the upper air and earth make it a tempting proposition to obtain power from atmospheric electricity. The power would take the form of high potential difference with a discharge almost of a static nature. It has long appeared rather doubtful to conservative engineers if such a source of power should really be available. Yet when we see the lightning flash, it certainly suggests very high power, even tho the total of its energy may be small, on account of the small duration of the discharge. It is not to the thunder storm that we look for getting power from the atmosphere, as the subject is now being seriously investigated. A German scientist, Hermann Plauson, has publisht a very elaborate work on this subject, and has investigated the use of kites, balloons and towers, for the utilization of the high potentials existing in the air at different altitudes, and has studied out the construction of motors to be operated by the peculiar type of discharge which will be obtained, if the projects are successfully carried out.

We will first speak of the methods used for collecting electricity from the upper air. The author cites several German patents. One of them shows the use of a kite balloon. The balloon is shown floating in the air, kite fashion, and from it hangs a great net or aerial for the collection of electricity. The conductor from the aerial leads to the ground station, quite an elaborate description is given of the net-work which the patentee proposes to have covered with needle points. A windlass takes in or pays out cable for the balloon, and the patentee claims that by sending the apparatus to a height of about one mile he will have 225,000 volts to draw upon. He then speaks of a battery of 20,000 cells in series, which will use up 40,000 to 50,000 volts in the charging. This certainly provides for a reasonably large fall of potential.

But our author discards this idea and first suggests something more permanent. He proposes the erection of towers to be in the neighborhood of 1,000 feet high, or about the height of the Eiffel Tower At the summit he has his collecting aerial. The appliance consists of a number of copper tubes; within each one he proposes to burn gas lamps, whose products of combustion will reach the aerial, a collecting net-work covering the tops of the tubes. One of his apprehensions is that if rain should wet his connections trouble might ensue, so he proposes a protection at the top in the shape of a great bell-like shield, resembling in his terms "a Siamese pagoda." He also compares the form of the protection to that of a great petticoat insulator. Another of his difficulties is that he must have his tower insulated from the earth. He, therefore describes a complicated foundation for his structure.

# Tiny "Ships" Probe Human "Seas"



The Illustration Above Shows Platinum or Silver Plated Capsule Fitted With Spring Doors or Valves Being Swallowed by Patient

Second Illustration Above Shows How Physician Locates the Exact Position of Collector Capsule Swallowed by Patient

When the Capsule Has Reached the Right Point the Physician Switches on Electro Magnet Which Opens the Capsule Doors to Take a Sample of Secretion or Else to Discharge Bacteria.

## Bacteria Laden Metal Capsules Swallowed in Experiments by Medical Students

DID you ever stop to think for a moment that much of the knowledge we have about a certain medical case is more or less guesswork, especially when it comes to ascertaining the effect of certain bacteria or medicines on a particular part of the gastro-intestinal tract? Such is the case, however, and in order to accurately determine just what effect the bacteria in buttermilk, for example, have on certain sections of the intestinal canal, Professor von den Reis of the University of Greifswald, Germany, according to cable dispatches, has been using with considerable success tiny, electro-magnetically controlled metal "ships" fitted with iron doors. One of the accompanying illustrations shows the shape and size of one of these metal cylinders, and anyone who has swallowed quinine capsules or especially the larger gelatine capsules containing various oils, et cetera, will realize that quite a large cylinder can thus be easily swallowed. The cylinders, which, by the way, are used to unload bacteria at any desired point in the intestinal tract, as well as to take on samples of the secretions at certain points in their travels, may be made of silver or some other metal plated with silver or platinum. A series of small iron doors or valves are fitted on the capsule and these can be opened and closed by means of a powerful electro-magnet placed against the back or abdomen of the subject, the position of the "ship" being accurately determined by means of the X-ray.

When the metal capsule with its load of bacteria, or else traveling in *ballast* reaches the desired point, Professor von den Reis excites the powerful electro-magnet, which causes the iron valves to open, these valves being closed by the pressure of a spring when the magnetic attraction is cut off.

The method of procedure in making a scientific test for the effect of certain bacteria on the digestive processes is as follows: The patient first swallows one or more of the capsules containing the bacteria and the travels of the capsules are traced with the X-ray, and their cargoes are discharged at the proper moment. Shortly afterward when sufficient time has elapsed for the bacteria or medicine to act upon the food in the intestinal tract, empty capsules are swallowed and when these reach the scene of action, as determined by the use of the X-ray once more, the trap doors are opened and a sample of the food being acted upon by the bacteria and the bodily secretions is trapped, and later these samples of the contents of the intestines are studied minutely in the experimental laboratory.

The layman might be somewhat alarmed at this remarkable method of accurately ascertaining just what is going on in his digestive processes, especially as he might suspect that ill effects would ensue from the powerful magnetic rays passing clear thru his abdomen, but his mind may be perfectly at rest on this score, for extensive tests made in Paris some years ago failed to show any effect whatever on the human body when it was subjected to the field of the most powerful electro-magnet obtainable.

# Heart Tissue Alive After Ten Years

Ten years ago Dr. Alexis Carrel of the Rockefeller Institute isolated a fragment of tissue from the heart of an embryonic chicken. The tissue kept on growing, it has kept on growing ever since. At first it was real heart tissue, and for 104 days, as the cells multiplied themselves, pulsations could be detected under the microscope — the beating of a heart. Then the connective tissue cells overran the others, and since then it has been connective tissue.

So fast does it grow that it would now be an enormous mass except for the fact that every forty eight hours it is subdivided and part of it discarded. Many generations of chickens have been hatched and have gone where good fowls go, but the substance of the chick that happened to be selected for Dr. Carrel's experiment on January 17, 1912, is perpetuating itself at just as lively a rate as ever. It is, so far as those who are watching and nourishing it can see, immortal.

The original culture has been subdivided nearly 2,000 times. The cells increase so fast that on the average the area of the culture is trebled in forty-eight hours. At the end of that period it is divided into two or three pieces, which are transferred to a bath of Ringer's solution. After forty-five seconds in this bath they are transferred to a fresh mixture of the medium used for perpetuating the strain, composed of equal volumes of chicken plasma and chick embryo extract.

They are then placed in an incubator and kept in an average temperature of 103 degrees Fahrenheit. The best plasma is obtained from healthy chickens not more than two years old which have not been fed for twenty-four hours. The tissue extract employed is obtained from chick embryos seven to eight days old. In his last report, published three years ago, Dr. Ebeling said the rate of growth seemed to have increased progressively during the first seven years of life outside the chicken heart from which the original tissue came.

During the first year the growth was slow and irregular, because it was not yet known that certain substances contained in embryonic juices were essential to permanent life.

The method of cultivating the chicken tissue is similar to that of cultivating disease germs. The use of culture material within sealed receptacles is necessary. The receptacles being of glass, the living tissues may be studied constantly.

# Invisible Airplanes

**Here's What We May Expect to See To-morrow, If the Dreams of an English Inventor Come True—Invisible Airplanes Which Will Dash Thru the Sky Like a Bird, Presenting a very Difficult Target for Anti-aircraft Guns, not to Mention Many Other Possibilities Resulting from This Novel Construction. The Invisible Airplane is to be Made Possible by the Employment of this Englishman's New Structural Material Which is Transparent Like Glass, but as Strong as Steel. If the Engine Can be Made of the Same Material, Then We will not See this Either, and When Fitted with a Suitably Approved Muffler or Other Silencer, the Airplane of To-morrow Will Truly Represent a "Terror of the Skies" in the Event of War.**

DID you ever stop to think what would happen if we could build flying machines of some invisible transparent material, such as glass for example? For one thing this design of airplane would make flying machines pretty difficult targets to hit with any kind of gunfire. And speaking of bombing-planes the metal parts of such transparent planes, if once adopted, would provide such a small object to the sight that, at an elevation of 7,000 to 10,000 feet, such planes, if made of transparent material, except the engine and a few minor parts, would be practically invisible even with high powered field glasses.

Well, just to prove that we are not exhibiting one of our dreams, we are glad to state that an English inventor, Mr. Ernest Welsh, has discovered a material having all the transparent properties of glass, while he confidently believes that this new structural material can be used in the manufacture of aircraft. If the airplane which now roars thru the sky over our heads could be rendered not only transparent and invisible, but provided with a first-class muffler, which is not improbable at all, its war-time possibilities would surely border on the supernatural. It may take some time, even several years, before such a machine is successfully designed and built, but the country which holds the secrets of the building of such a flying machine will, it would seem, possess a tremendous advantage over its enemies.

Looked at from the humorous point of view, this transparent airplane stunt suggests some very desirable features indeed, especially on the morrow, when we have air traffic lanes policed by eagle-eyed air cops, for then we can speed right along and disappear into the fourth dimension, as it were, owing to our invisibility. Also when we are courting a pretty girl and papa objects, we can dive down in front of her home right before his nose, and whisk her away.

The inventor of this new transparent glass-like material does not state whether he believes the engine could be built of it or not, but if all of the rest of the material except the engine could be built of this material, it would still be a great boon, especially in military and naval maneuvering.

# "Gold Maker" A Fake, Prof. Fisher Finds

Prof. Irving Fisher of Yale University, who recently caused a sensation by stating that a certain German scientist had apparently discovered a method of producing synthetic gold, has abandoned his treasure hunt.

"I met a man who, I was told, had succeeded in making artificial gold," said Prof. Fisher, "and he offered to demonstrate his claims. He said he submitted samples of gold which he alleged he had made to the Reichsbank in 1917, and that the authorities of that institution found it to be 999 pure. Herr Havenstein, President of the Reichsbank, told me this was correct, though there was no proof that the gold was synthetic. The alleged inventor gave me to understand he used mercury as a basis and said he employed an electric vacuum furnace with a more perfect vacuum than had ever before been obtained."

"Did you go to see the inventor's experiments?" I asked the professor.

"No," he replied. "I saw a distinguished German scientist this morning and he told me the man is a fraud and has a prison record. My friend who originally gave me the information about this man had known him for years and assured me the man is not a fraud, however mistaken he might be about his invention. I am disposed to believe my friend has been misled."

Prof. Fisher went on to say the alleged inventor declared he could produce synthetic gold for "10 per cent. less than the present price of silver," a curious statement, though it might be accounted for by the man having used silver as one of his bases for experiments.

"But why has he done nothing since 1917," I asked, "if he has made such a tremendous discovery?"

He explained that quite plausibly by saying he had been busy with other inventions which would benefit Germany, while he was doubtful if synthetic gold would help the country.

Prof. Fisher, who has come to Germany not only to investigate this matter, but to study the currency question, told me he found that during the war the German Government did make serious attempts to produce gold in new ways. They did, in fact, succeed in extracting gold from sea water, but not at a profit.

"These attempts," he added, "have been abandoned, and I have no evidence that the German Government is making further efforts."

SPECIAL RADIO ISSUE

# Science and Invention

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Awards of the $300.00 RADIO PRIZE CONTEST "The Simplest Radio Outfit"

THE SUPER NOSE

*See Page 1113*

# Doctor Hackensaw's Secrets

## By CLEMENT FEZANDIÉ

### No. 4—The Super-Nose

*(Author's Note—If there has been one branch of science more neglected than any other, it is the science of smells. We have microscopes to help the sight, and microphones and audions to help the hearing, but nothing as yet to help the sense of smell. In this story I have endeavored to show some of the important uses to which a smell-intensifier could be put, for I am convinced that when men realize what valuable services such an instrument could render, the instrument will not be long in forthcoming.)*

"'But I Cannot Pass Over in Silence the Immense Value of the Instrument to the Physician in Diagnosing Disease. . . . Every Disease Has Its Own Characteristic Odor. . . . In Female Hysteria, for Example, There Is a Scent, as of Violets and Pineapple, and in Peritonitis There Is an Easily Recognizable Scent of Musk,' Continued Dr Hackensaw. 'I Merely Walk Thru a Hospital and One Sniff at a Patient Tells Me What Disease He Is Suffering From.'"

"WHAT do you say you call that instrument, Doctor Hackensaw?"

"This, Mr. Rockett, is what I call a *Super-Nose*," answered the doctor.

"A super-nose!" echoed Silas Rockett, "what in the world is that?"

"It's an instrument for intensifying smell."

The reporter snorted: "Good-night, doctor!" said he. "Keep your super-nose for those that want it. I live in New York City in a flat where somebody cooks cabbage almost every day and limburger cheese flourishes on Sundays. I find the smells plenty strong enough as it is. If you start to intensify them you can transform the city into a desert, inside of a week!"

"Pshaw!" exclaimed Doctor Hackensaw.

"And even the pleasant odors," continued Silas Rockett, "even *they* become oppressive if too powerful. I worked for one week in a vanilla factory and I found that even the delicate odor of vanilla becomes sickening when too strong!"

"True," replied Dr Hackensaw, "but have you ever seen a dog annoyed by a strong smell? And yet you will admit that the dog's nose is far superior to yours. A manure heap that would make you sick would to him be a pleasant odor. So with my instrument, I have been surprised to find that odors which are intensely disagreeable, often, when highly magnified, become most pleasing. But that's neither here nor there."

"Tell me, doctor, how you came to think of such an instrument?"

"Well, I was reflecting upon the conquests which man has made over Nature. At the present day man is superior to the brutes in every respect but one. In his automobile he can run faster than the swiftest horse, in his airplane he can fly faster than any bird, in his submarine he can swim more rapidly than any fish. With his telescope he can see further, and with his microscope he can see better than the animal with the keenest vision, and with his microphone and audion he can hear better than any known animal. It is only in the sense of smell that he is still inferior to the lower animals. The scent of a dog is far superior to that of a man, while we have good evidence to show that certain moths can scent their mates at the distance of a mile or so!"

"I see. So you decided to secure for man a scent as keen as that of the dog. But how did you set about it?"

"My first attempt," explained Dr Hackensaw, "was made with a nose trumpet. I thought that, just as an ear trumpet collected more waves of sound so a nose-trumpet would collect more of the odor and so intensify the smell. But a few experiments soon convinced me I was on the wrong track. The magnification of the smell was too small to be of any real value."

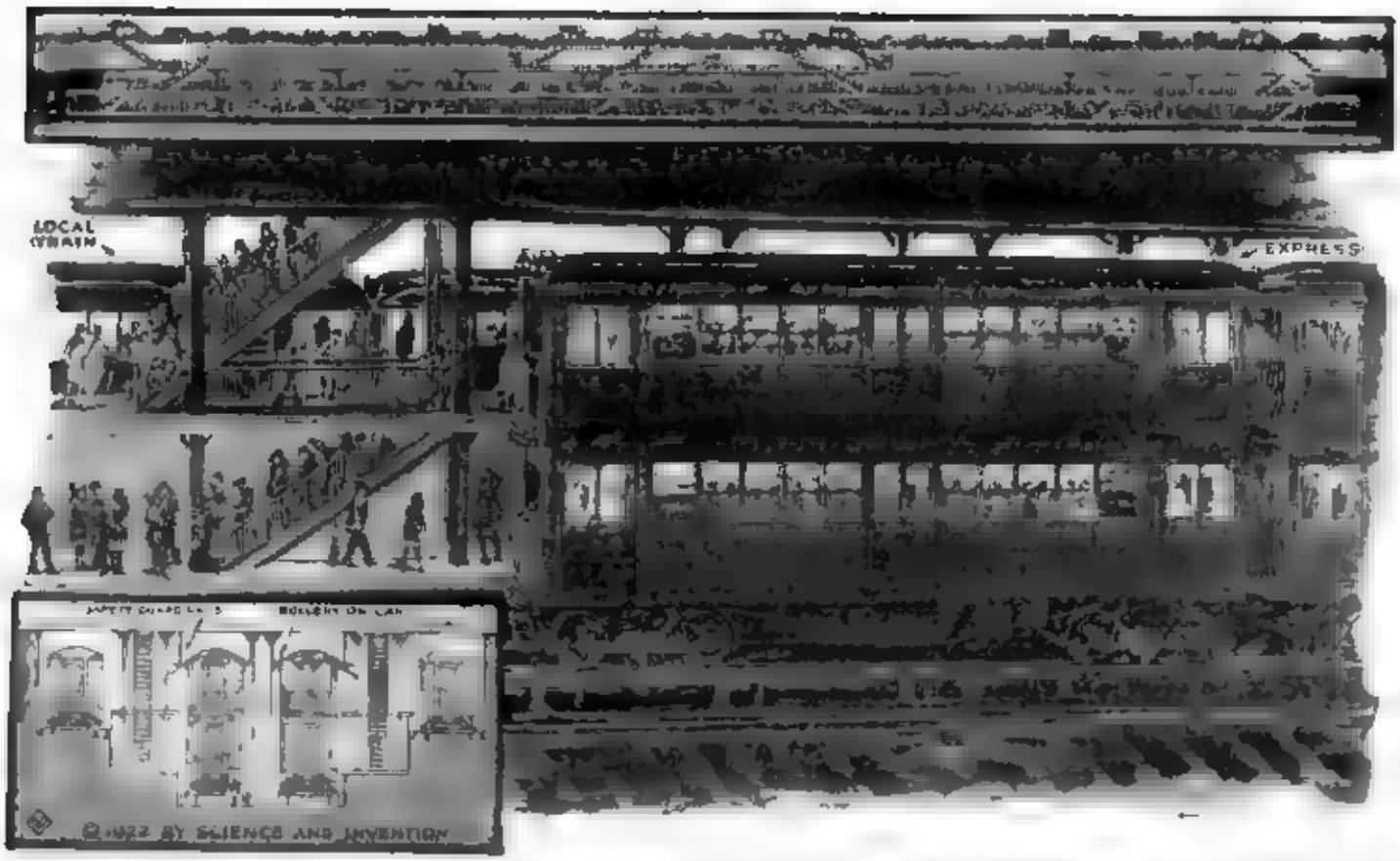
"Well?"

"The next thing I tried was improving my nose. Under the microscope I carefully dissected the scent glands of the dog and the antennæ of the moth, hoping, but in vain, to learn the secret of their power. Next I tried grafting the lining of a dog's nostrils into the nose of one of my assistants, who for the sake of science consented to the operation. I tried it on myself, too, but with very slight success."

"Good gracious!"

"Then I tried condensing smells. I placed one drop of scent in a room and left it until it had become imperceptible. Then I gathered the air of the room into a cylinder, liquefied this air, filtered out the inert liquid and thus obtained a concentrated solution of the odor. This method was much more successful. By its use I can detect the passage of a man several hours after he has passed. The method is, however, too clumsy and cumbersome for practical use. Finally,

(*Continued on page* 1191)




**Why Not Double Deck Subways for the Larger Cities Like New York, Philadelphia Boston and Chicago, Where the Traffic Congestion Problems Have Reached Unbelievable Proportions? Some Engineers Have Advocated, in New York City for Example the Use of More Subways, Spreading These Along the Different Avenues. The Present Writer However Has Struck on the Idea of Using Double-Deck Subway Cars Which Could be Ready Adapted to the Present Subway System, While in Operation and at a Minimum of Expense Time and Labor. The Greater Head Room Required for These Cars Would Necessitate Excavating and Shoring Up the Tracks, Section by Section, to Prevent the Interruption of Traffic**

# Why Not Double-Deck Subways?

**By H. Gernsback**

**Member of American Physical Society**

At the present time we are confronted by the rather serious conditions existing in our great local transportation arteries known as the subways of the larger cities. Take, for instance, the subways of New York. It has come to a point where a rider becomes a physical hazard. It nothing is done to relieve this condition, it will undoubtedly affect the population adversely in the next generation. It is impossible or impractical today to run more than ten car express trains. Neither can we run the trains faster nor can we do now more than 25 trains. As the city expands more and more people crowd into the subways and the congestion becomes more pronounced every day.

I propose a plan which has been thought out carefully which is possible from an engineering standpoint and which will immediately increase the capacity of the present subways 100 per cent. The basic principle which I present here I can explain in a few words. It simply means the building of double-deck subway cars, that is, cars something like our buses now use today. But this double-deck subway car's carrying capacity of each train will be increased exactly 100 per cent. The cars of course would be almost twice as high as they are now but the exact amount is about 85 per cent higher. Physically each car has two decks. Each car will be exactly like the one we have of today, seating and standing room just as at present. There would be no stairs connecting the upper and lower level of the car. Passengers would board the new double car in the same manner as they do now. This necessitates, of course, two platforms, one above the other. The upper and the lower doors of the new cars would all open simultaneously, so that the loading of the upper and the lower decks would take place at the same time. There is no technical difficulty in this. All we need to do is to build new platforms directly underneath the old ones, and to lower the roadbed of the present tracks about six and one-half feet. This also presents no engineering difficulties today, as the entire excavation can be done without stopping a train. The new roadbed could be excavated right under the present tracks, which latter would be underpinned the same as our streets are now underpinned when a new subway. Traffic is never interfered with.

When the new roadbed with the tracks and electrical equipment is finished, it will take less than a month to knock out the remaining portion of the old track bed. During that time it would be possible to accommodate all the traffic with the present old tracks running the locals as expresses southward in the morning, and northward in the evening. Anyway it should not be any worse than it is today and could be figured for much less. If the new cars would demonstrate as we think they would, a double capacity, I do not think that it would be necessary to use double-deck cars on the local tracks, as a study reveals that locals are never very busy except during rush hours. It is necessary a change to the double-deck cars could always be made at any time later.

It might be thought that such cars would be very heavy and cumbersome, but such is not the case. Their weight would not be more than 25 per cent above the weight of our present cars, which includes the extra 100 per cent of passengers that they will carry.

From the operating standpoint it should also be noted that the double-deck cars could not start much more than the single present ones. There would not be an increase of 50 per cent, and this would be very interesting to our traction companies, who would be able to collect more fares at practically no expense. No extra conductors would be absolutely necessary for these cars, but extra pilots would be required on the new platforms.

Contrary to the popular opinion, double-deck cars would not be top heavy because so much of the weight would be near the tracks and down at the bottom. Guard rails could be placed along the track and rollers on the cars. These would serve the purpose of preventing the cars from tipping over when going around curves should their motion become too rapid. There is, however, the danger of this as the fate of our present buses shows. It is also to be reckoned with for such a bus to overturn in the loop of course be that the accident danger is very low.

A new system of [illegible] the "up" and the "down" express over the double-deck cars. In the evening rush hours the upper deck would be available for all passengers to the Forty second Street [illegible] That means that passengers coming from the train at Forty second Street would find an empty train as far as they are concerned. That is impossible at present. In the morning hours the scheme can be reversed as would be found best by actual operation.

The entire scheme which I propose here could be put to operation at once without trouble within a year's time and provide subway riders who were suffocating relief could be had for the city.

# The Gravity King

By CLELLAND J. BALL

ELIAS CRAIG, president of the American Airplane Co., Inc., swung slowly around in his swivel chair and faced his secretary who had just entered his private office.

"Well," he growled tersely, "What is it?"

"There is a messenger outside, sir," the secretary replied, "who has a letter which he insists upon delivering to you personally."

Hmm—— Well, maybe its concerning that Lake Arbor deal. Show him in," and Craig turned back to his desk.

The secretary slipped out quietly and almost immediately the door opened and admitted a self possessed young man of about twenty-six years. For an instant he paused at the door and surveyed the broad back and bullet head covered with iron gray hair of the man before him. Was it the shadow of the cloud that passed over the afternoon sun that darkened his eyes, or was it a look of bitter hate? But whatever it was it was gone almost as soon as it appeared, and he advanced with a quick firm step to the desk before him, and laid a sealed envelope before the president.

"There's no answer," he said as Craig looked up curiously, and before he could be questioned further he was gone.

"Quickest messenger I ever saw," growled Craig sarcastically to himself "wasn't from the Lake Arbor people, either," as he opened the envelope with a quick movement of the cutter. Unfolding the letter he read with growing amazement the following:

May 17th, 1940

AMERICAN AIRPLANE CO., INC.,
ELIAS CRAIG, *President*
City

DEAR SIR,

The airplane of the present type is destined in a few years to be entirely obsolete. No doubt you will smile at this statement but I have the proof at hand in my latest successful invention—a super airboat which cannot fail to the earth, and which should attain a speed of three hundred miles per hour.

You will be startled to learn that after years of intensive experiments, I have finally discovered the great principle that makes my airboat a success, namely, *the repulsion of gravitation!*

Further details I cannot discuss in this letter. I have written you because of the immense capital you and your company represent. This capital is needed at present in order to properly place my invention before the public.

I shall be pleased to give you and your directors a demonstration with a small model tomorrow evening at 9 o'clock at my present address.

You as a business man must realize what it will mean to the company that first secures manufacturing rights to my machine. "A word to the wise——" you know. Very sincerely,

ABRAHAM NORTON

77 Oakhurst Ave.

Now presidents of large corporations are accustomed to receiving letters from all grades of inventors, most of whom offer world revolutionizing inventions which, however, revolutionize nothing but the inventors pocket books—but Abraham Norton—ah, he was a different proposition. Appearing in the city a few years before the opening of this story, he had already produced several small but important and successful inventions, and he was known as a man of keen intellect and logical mind. While Craig did not know the man personally, he had often heard of him, consequently he stared dumbfounded at the letter in his hand for hearsay told him that Norton was not the man to say one thing and mean another.

God! he called "the repulsion of gravitation! Is it possible?"

Sinking back in his chair his crafty brow wrinkled in thought, and his active mind swarmed with a thousand pictures. What an invention to control exclusively!

(*Continued on page* 1178)

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The Financiers Were Not Only Interested but Amazed by the Demonstration of the Gravity Defying Airship, Which Exerted Such a Powerful Lifting Effort That It Almost Raised Its Cigar Shaped Shell Counterpoised. Carrying Two of the Spectators With It. Yes It Looked as if Its Inventor Had at Last Solved the Problem of Neutralizing Gravity and Free Flight by What They Didn't Know As This at That Very Minute They Were on Board a Powerful Airship Flying 10,000 Feet Above Their Heads Over and Rapidly Nearing Its Way Toward an Uninhabited Island in the South Seas.

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"Without Any Imagination at All, but Simply by Geological and Scientific Reasoning From What We See on the Moon's Surface, I Believe," Says the Author, "That There Is Now Inside the Moon, and Some Day Will be Inside the Earth, Great Caves and Caverns Such as Those Shown, For the Reason That the Disappearance of the Moon's Atmosphere Caused Nature to Suck All the Water Inside, Along with the Air. The Moon's Inhabitants are Therefore Cave Dwellers"

# The Man in the Moon—A Super Cave Man

## By C. S. CORRIGAN, C. E.

EVER since childhood you have thought of the Man in the Moon as the picture you imagined you saw on the outside when you look thru a telescope facts are revealed, the picture vanishes, and you see what is often described as a pearled orange studded with jewels and draped with strings of beads. The jewels are the craters of extinct volcanoes, the strings of beads radiating from some of them show where rivers of lava once flowed; the telescopes also show that the smooth floors of ancient oceans are dry as deserts, and that there is not enough air on the moon to sustain life. Scientists have also proved that having no atmosphere to retard them, the sun's rays shine hotter on the Moon's surface than even on the top of Earth's highest mountains, but in the Moon's deepest valleys there is only 1/50th as much heat as at the top of Mt. Everest so this heat is dissipated so quickly that even during a two weeks' long day the ground never gets half as warm as the ice on the top of Mt. Everest 40° F. below zero, during a lunar night it is as cold as space 459° F. below zero.

Although these facts were well known years before Poe wrote thru an imaginative telescope of tremendous power and wrote for the *New York Sun* a wonderful imaginative story of the doings of little men on the Moon, which has been named by litterateurs "The Moon Hoax."

Now Prof. Pickering of Harvard University considering slight changes in color on the floor of some large lunar craters, where intermittent signs of water vapor appear has made himself believe that organic life still exists on the Moon. Forgetful of the bright colorings, due to water vapor in rare atmosphere, seen on some of Earth's lofty mountains, he even goes so far as to imagine some airless heat retainer and water vapor distributor right at the Moon's surface, capable of distributing so much heat and water that crops grow and ripen in 4 or 5 of our days, so a race of human Eskimos on the Moon might come out of their huts and farm these crater floors gathering two crops a lunar day on which to live during the two weeks' long night.

It is said that facts are stranger than fiction, and this is especially true of the

(*Continued on page 1187*)

# Airship "Roma" Falls and Burns Up

ANOTHER terrible catastrophe of the air occurred on February 21 the day before the nation's celebration of Washington's birthday, when the largest semi-rigid airship, "Roma," built in Italy for the United States Army was destroyed with a loss of thirty-four of her crew of fifty men. The accompanying illustrations show, in movie fashion, the successive stages of this accident. Altho many theories and wild stories were circulated and published in newspapers directly after the disaster, the "Roma," which burned up after it hit the ground, a clean hull to wreck was given the giant ship of the air by Lieutenant Colonel A. E. Fisher chief of the lighter-than-air service at Langley Field home station of the "Roma," and he stated that "there was nothing wrong with the craft when she left there on Tuesday on what proved to be her last flight."

Captain Reed said that it was a plausible theory to believe, as had been suggested, that the kite box hung down at the tail of the "Roma" so heavily as to displace the balance and point the ship into the nose dive.

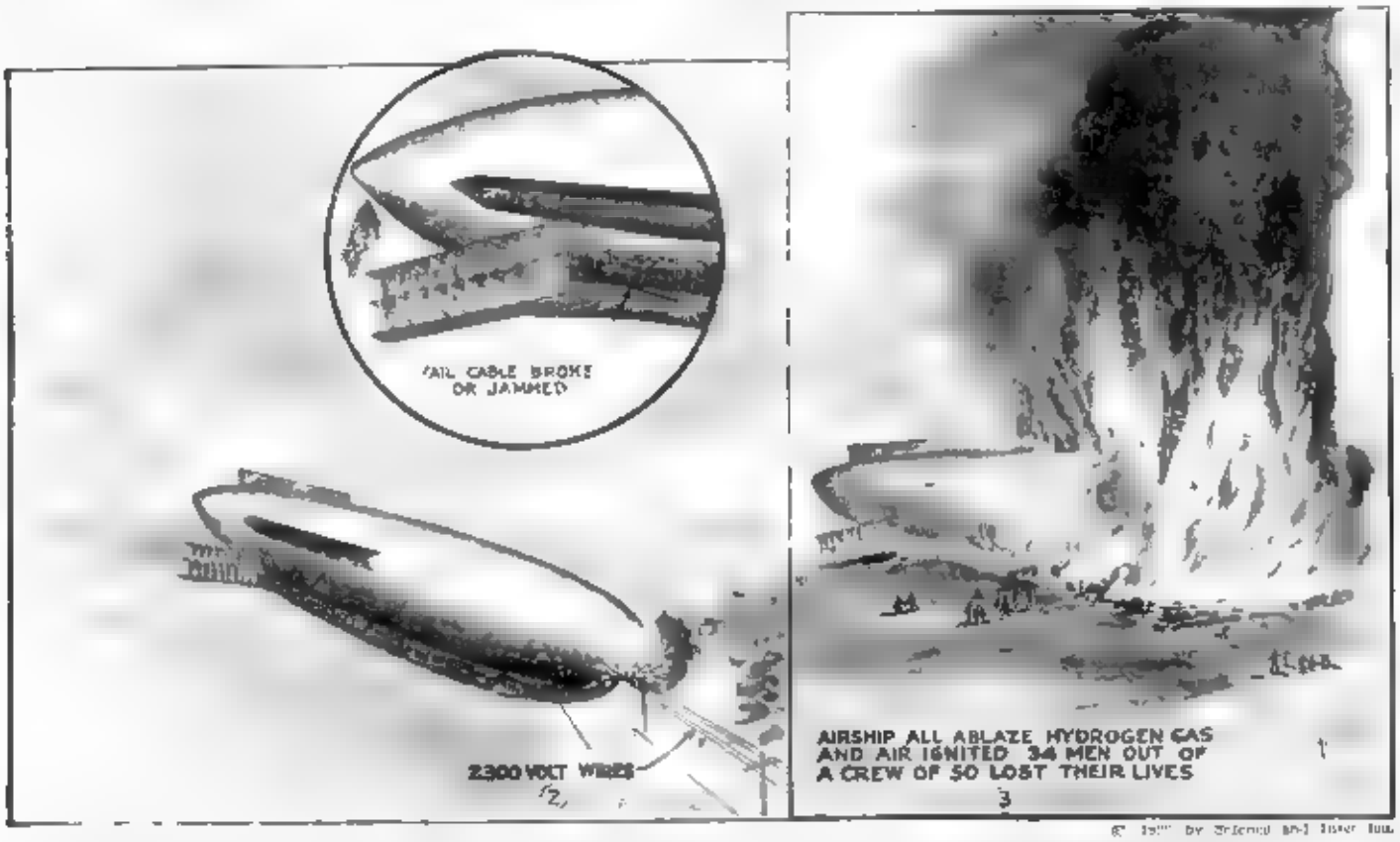
The facts in the case so far as they can be learned, seem to indicate that the cables [illegible] on the ground [illegible] Roma back to the rudder control [illegible] or else [illegible] and [illegible] and that the [illegible] jammed [illegible] Both [illegible] caused the nose of the airship [illegible] and as it [illegible] several of the survivors [illegible] to become [illegible] to a level keel, even when ballast was thrown overboard, and the next instant she crashed to the 2,300 volt feed wires supported on poles. When some of the metal work on the airship hit these wires, sparks were caused by the short-circuiting of the wires, which ignited the hydrogen gas mixing with the air, hydrogen itself not being explosive.

The official investigators may [illegible] only like about the great number [illegible] that would have been lost had the "Roma" been filled with helium gas instead of the inflammable hydrogen gas, but we confidently believe that the government authorities, including Congress, and the aircraft experts and officers in charge should have seen to it long ago that a good stiff argument was waged for helium gas, for when hydrogen gas is used there is no telling what is going to happen to such a 410 foot long envelope filled with it, whether the ship falls or takes a nose dive and crashes, or hits electric wires and causes a short circuit which might have been the case in this accident.

Even tho several of the crew that managed the ill-fated "Roma" survived the disaster, including Captain Walter J. Reed, chief pilot of the ship, the exact sequence of events which precipitated the great gas filled bag down on the high tension wires (undoubtedly forming a short-circuit and igniting the hydrogen gas as some of it mixed with the air from punctures in the envelope of the airship), will never be known. Captain Reed, in a statement given out the day after the accident, as he lay at the Public Health Service Hospital, stated:

"I have no idea what caused the [illegible] and I [illegible] never be known. Of course we have our own theories, but we are not certain which is correct. I had known that there was trouble with the control of the ship, and it was impossible to correct it after it was discovered."

Helium gas is strongly argued for and the government severely criticized by




**A Few Weeks Ago the World's Greatest Semi-Rigid Airship, the "Roma" Purchased By the U. S. Government for Army Use from Italy Became Uncontrollable, Due to a Lowered or Jammed Rudder Cable and Came to Grief in a Nose Dive. Thirty-four of Her Crew of Fifty Men Lost Their Lives. It Is Thought That the Hydrogen Gas with Which the Airship Was Filled, Mixing with the Air Caught Fire When the Frame of the Giant Airship Struck 2,300 Volt Feed Wires Carried on Poles Which Caused Electric Sparks and in the Next Few Minutes the Massive Craft Was a Seething Inferno. It Was Impossible to Rescue Some of the Men Whose Lives Would Undoubtedly Have Been Saved If the Gas Compartments Had Been Filled with the Non-combustible Helium Gas Instead of Hydrogen, Many Experts Now Believe**

There is one question uppermost, perhaps, in the minds of many and that is why the non-inflammable helium gas was removed from the "Roma" just a few days before the accident and the dangerous hydrogen gas replaced in her gas compartments. One of the reasons given for the removal of the helium gas was that it was desired to conserve this store of the gas, all of the available quantity of which was in the "Roma's" balloonets. Another point brought out in the arguments at Washington concerning this question was that such a catastrophe would never have happened, or at least the toll of lives would only have been a fraction of those killed in the "Roma" disaster, if Congress had appropriated sufficient funds for the further separation of helium gas, which is produced by the government plants at Fort Worth and Petrolia, Texas.

[illegible] A Taker of the United States Naval Reserve Force, now [illegible] at Washington [illegible] Taker made the statement [illegible] as we have it now [illegible] the "Roma had been filled with helium gas there would have been practically no loss of lives." This expert believes that Congress made a most serious mistake in not appropriating sufficient funds to have developed ample helium gas for all of the dirigibles which the Army or Navy might have in use. To quote Lieutenant Taker further we learn:

"If the 'Roma' had been filled with helium instead of hydrogen there would have been no explosion and no burning of gas. As it was, there was a terrific blaze from the burning of more than a million cubic feet of hydrogen gas, and the bodies were charred to a crisp.

RADIO BROADCAST MAP

MAY

# Science and Invention

20 RADIO ARTICLES FOR THE BEGINNER

ELECTRIC WELDING UNDER WATER

See Page 15

# Electric Welding Under Water

## By ROBERT G. SKERRETT

While [illegible] under water nevertheless a diver can [illegible] ment is not a mere laboratory spectacle [illegible] engineering [illegible]

We are fairly familiar with the oxy- [illegible] which it is put in the open air in cutting [illegible] heat if not somewhat higher and this is [illegible] tongue of flame

The oxy-acetylene torch has been in- [illegible] ing up repairs on ships, and the problems [illegible] would be much helped if he, too, could have at his command a kindred apparatus. This was ingenious Germans tried to meet about twelve years ago, and with a measure of success. Their torch burned fairly well, under water at moderate depths of [illegible] 20 feet, but at a greater submergence the oxy-acetylene gas became balky. The stuff back-fired—in short, expanded instead of burning in a flame. This is one of the peculiarities of acetylene when ignited at a pressure of 30 pounds or so.

Four years back, two Americans tackled this subject from another angle, and Ralph E. Chapman and J. W. Kirk produced a subaqueous torch that combined [illegible] under water. Herein lay a decided improvement, because the German torch had to be lighted in the open air before it was taken below the surface. If, by chance, the American torch was doused and put out, it, like the Teuton apparatus, could be relighted on the job by the diver. This first cutting tool was further improved and used effectively during the [illegible] of a big [illegible] Atlantic liner then sunk in New York harbor, and with it holes were cut through a number of [illegible] heads, the deepest of these openings being about [illegible] feet down.

Within the last two years the torch has been still more modified and greatly bettered. The use of acetylene has been unanimously abandoned and the electric arc is now counted upon to do most of the cutting. A [illegible] employed in combination with the electrode but, strictly speaking, its main function is to blow the softened metal aside, altho it also helps in the actual cutting. In addition, the gas creates a vaporous atmosphere immediately about the arc, and pushes away the [illegible]

Current at a low voltage (about 10 volts) is delivered to the electrode by a conductor carried inside of an armored hose, which also conveys the gas to the point of action. The torch, itself, is composed of a carbon electrode pierced transversely by a couple of little tubes which discharge the needful gas from the top of the electrode. The instant the diver brings the carbon within a fraction of an inch of a metal surface an arc is induced [illegible]

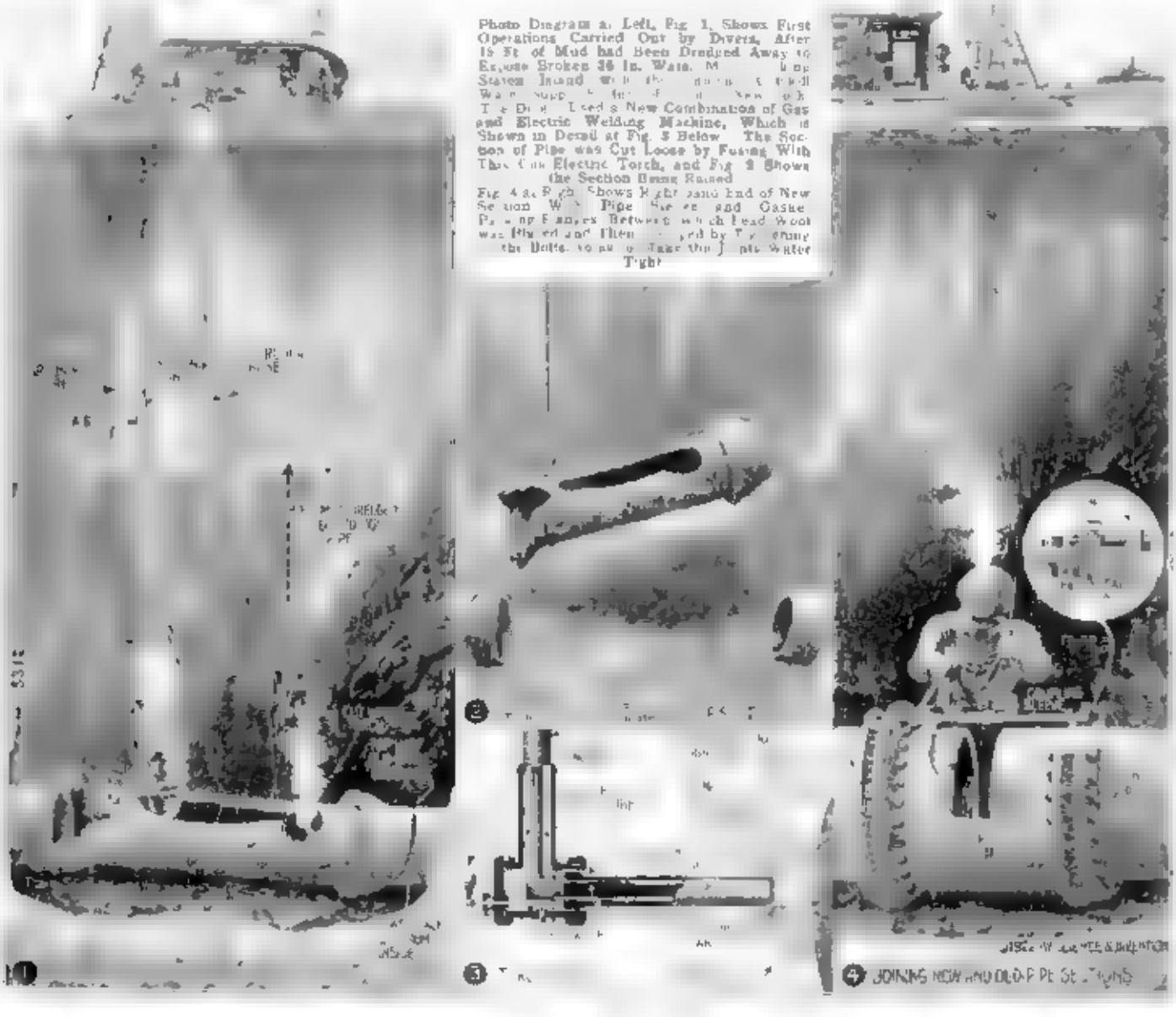


Photo Diagram at Left, Fig. 1, Shows First Operations Carried Out by Divers, After 15 Ft. of Mud had Been Dredged Away to Expose Broken 36 In. Main. [illegible] Staten Island with the [illegible] Water Supply [illegible] New York. The Divers Used a New Combination of Gas and Electric Welding Machine, Which is Shown in Detail at Fig. 5 Below. The Section of Pipe was Cut Loose by Fusing With This Gas Electric Torch, and Fig. 2 Shows the Section Being Raised.

Fig. 4 at Right Shows Right and End of New Section With Pipe Sleeves and Gasket Packing Rings Between which Lead Wool was Placed and Then [illegible] by Tightening the Bolts, to Make Sure the Joints Were Water Tight.

1 [illegible]

3 [illegible]

4 JOINING NEW AND OLD PIPE SECTIONS

# A Tropical North Pole

## By C. S. CORRIGAN, C.E.

EVERY school boy knows the climate of the North Pole used to be tropical. Great beds of coal in the far north prove that for millions of years in the Carboniferous Age its climate was just as warm as any other part of the earth where coal is found. The various plants and trees preserved in glaciers in Alaska and other arctic countries show that the climate was super-tropical up to the day they were frozen, the excellent state of preservation of dinosaurs and other prehistoric tropical animals found in arctic glaciers proves that they were caught in the ice while alive. The movement of the glaciers ground all vegetation, animals and surface rocks to powder, so it is only a few that were lifted clear of the surface by side pressure before the general movement started, that have been preserved for us.

It is less than fifty years since it was first shown that the glaciers in ancient times covered a great deal more of the earth's surface than at present, their deposits of glacial drift and the cutting effect of their movements have been so extensively mapped and studied that their location and area is quite definitely known, but the number of glacier periods and the cause of their forming is still a matter of dispute among scientists.

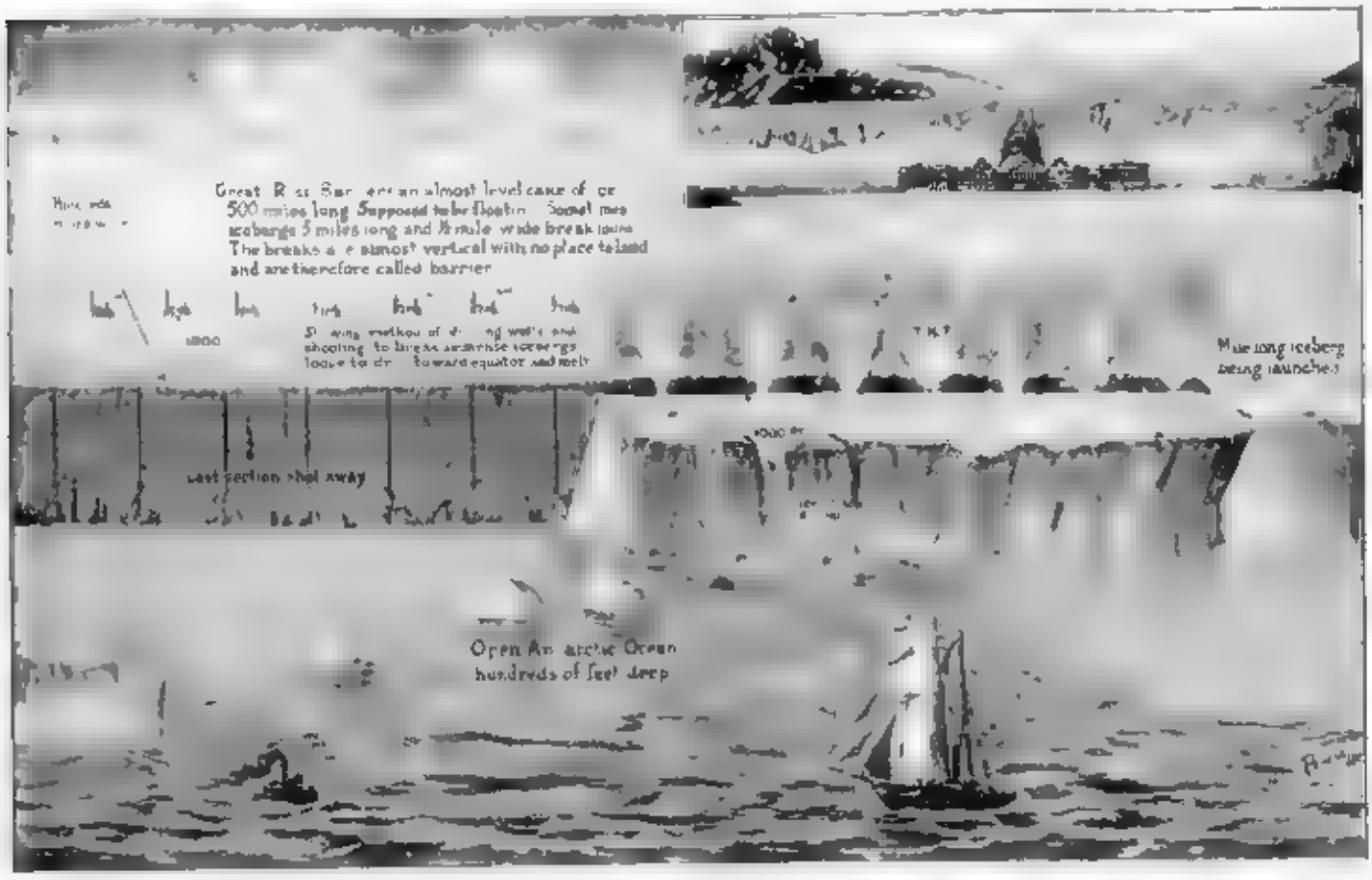
Some geologists claim there have been many glacial periods, others say only one. Some astronomers claim they were caused by great variations in the earth's orbit or of the equinoxes, some figure there is a conical movement of the earth's axes that would bring a glacial period every 31,000 years, no regular movements of the earth, at great intervals of time, could have taken place without there being more than a thousand separate strata in sedimentary rocks to prove it, but they have not been discovered. Some think glacial periods were caused by great volcanic eruptions that filled the atmosphere with dust and so shut out the sun's heat. If so, glacial ice would have been filled with volcanic dust and the plants and animals covered with it, but glacial ice and all objects in it are clean.

Knowing that when the sun's heat is at a minimum, as at night, the air and earth cool quickly, also knowing there are at times gigantic eruptions on the sun, such as sun-spots, that are dark and so reduce the amount of heat and light coming to us, it seems to me the only logical explanation of the origin and progress of the last (if there has been more than one) glacial period, as that 40,000 years or so ago there was such an exceedingly gigantic eruption, or sun-spot that the sun's heat was practically shut off from the earth. Then in a few hours an awful sleet storm started at both poles, and covered everything with ice, like sleet storms do nowadays. The cold wave extended so far and lasted so long that nearly all the water vapor in the atmosphere was precipitated and covered the land with ice.

However, there was enough warmth near the equator to keep things from freezing solid, or a animal life would have been destroyed, as water does not freeze until cooled to its entire depth, it probably took a long time for the great lakes to turn to solid ice, great ocean currents like the Gulf Stream and Japan current kept the polar oceans warm, so probably they were not frozen much more than at present. The scarcity of water vapor in the atmosphere greatly increased the evaporation from the warm oceans, then the rapid flow of warm air to the colder land regions made great and continuous snow and sleet storms, so the original ice glacier, only a few feet thick, was soon covered with mountains of snow, that by its own weight was compressed into ice until the glacier was thousands of feet thick, and weighed more than a hundred million million tons.

The gigantic sun-spot may have lasted a week, or a month, at any rate it was only a short time before the sun regained its full light and heat giving power, but ice does not melt as quickly as it forms. It takes ten thousand times as much heat to melt a cubic foot of ice as to raise the temperature of a cubic foot of air from 32° F. (freezing) to 88° F., the average tropical temperature, so although the sun immediately began melting the glacier in the torrid zone, much faster during the day than it re-formed during the night, and much more of it each summer than was made each winter, it took at least ten thousand years to make the permanent glacier recede as far north as the Great Lakes, for estimates based on our most reliable data show it would have taken that long to move the glacial drift we find in Illinois, Ohio and New York the 300 miles it came from its original location in Canada.

(Continued on page 75)




It May Be That in Years to Come Engineers will Go Northward for Their Ice and Start Breaking Up the Huge Glaciers in Some Such Fashion as That Illustrated, the Huge Blocks of Ice Being Towed to Warmer Climes Where They Can Be Broken Up for Everyday Use. The Vast Extent and Height of One of These Glaciers Is Seen from the Accompanying General View, as well as from the Insert Picture Which Shows the Comparative Size of the Capitol at Washington Standing 287 Ft. High, with the Huge Ice Cliff of the Child's Glacier Measuring 250 to 350 Ft. in Height

# Wonders of Modern Theatres

## By ERIC A. DIME

### STAGE SCENERY OPERATED BY AUTOMATIC MACHINERY

AMONG the latest uses to which time, money and labor saving machinery has been applied can be [illegible] of the modern stage. The [illegible] and rigging of scenery [illegible] stage [illegible] by means of [illegible] and sagging. These tapes [illegible] the weight of each stage [illegible] and [illegible] stacked against the [illegible] scene shifting. It has [illegible] such scenes [illegible] the

June

25 cents

# Science and Invention

*How to build*

## A RADIO OUTFIT IN YOUR SUITCASE

*See Page 152*

# Frederick Winsor--First Gas Inventor

## By EDWIN IRVINE HAINES, B. S.

THAT "History is neglectful" is a time-worn complaint. For nearly a century and a half the scientific world, not to mention the general public, has given credit to one William Murdoch, a Cornish mechanic, as being the discoverer of coal gas and the first man to invent an apparatus for its successful manufacture and distribution. Everyone has heard of William Murdoch. His name is as familiar to science as that of Christopher Columbus is to the schoolboy.

Those who are curious or skeptical may find in the New York Public Library a little book, yellow with age, entitled, "A Historical Sketch of the Origin, Progress and Present State of Gas Lighting," published in London, in 1827, wherein is to be found the only record of Frederick Winsor's great achievement with dates said to be earlier than those of William Murdoch's invention by eight years.

A great deal concerning the life of Frederick Winsor is unfortunately missing. No one knows when and where he was born or when he died. The only record we have of his life is sadly lacking in these details. But what little can be learned about him is indeed a revelation.

We first hear of Frederick Winsor as a teacher in a Sunday school in the little English hamlet of Soho, a suburb of the present city of Birmingham, in 1789. In those days Sunday schools were "confined to teaching the art of reading" so that the poor illumination as furnished by *tallow dips* caused *grievous inconvenience and injurious eyesight* to the scholars in the dark winter days.

One evening a certain scholar by the name of Thomas Carpenter noticed that "the air from the coal stove burned very bright and vigorous." Directing the attention of his teacher, Mr Winsor, to the discovery the "learned and scholarly gentleman" started a series of experiments in his leisure hours.

Frederick Winsor was a public-spirited man. Here was something that might be used to the advantage of humanity as well as to the scholars of the Sunday schools. He had no money to speak of, but what little he had he decided to spend on experiments with "the brightly burning air of the coal stove."

For an interval of thirteen long years nothing was heard of Frederick Winsor, and the biographer forgets to mention how he lived or to what extent his experiments had progressed. That, somewhere in dingy old London, the genius was working with dogged energy and persistence upon his discovery there can be no doubt. Nor was he aware that during this period a rival had arisen who, for many years afterwards, was to receive the credit that was rightfully his own—the first man to discover illuminating gas and a process to manufacture it commercially.

In 1797—said to be some years after Mr Winsor's original discovery—a wealthy mechanic of the same town of Soho, William Murdoch by name, had also experimented with coal gas and had used it to illuminate his home and offices at Redruth in Cornwall. And he was enabled to exhibit his invention on a large scale in 1802, and to obtain the interest of certain influential members of Parliament as well.

In the same year, however (1802), "Mr Winsor's Patent Gas Light and Coke Scheme," as it was called, commenced to attract public interest to such an extent that Edmund Burke, the great Irish orator of the House of Commons, characterized the city of Birmingham as "the toy shop of Europe." But Winsor was poor and unheard of, had no money to exploit his invention, and therefore his "scheme" was treated with contempt and ridicule.

That Dean Swift, one of the world's greatest satirist, realized that Winsor was being robbed of his discovery, is shown by a remark that he made at the time. "Oh, give me honest fame, or give me none."

Having raised some money by selling to the public some stock in his National Light and Heat Company, Winsor publicly exhibited at the Lyceum Theatre in London, in 1804, his method of using illuminating gas, and three years later succeeded in lighting a portion of Pall Mall.

"His statements were combatted," says an old scientific journal of that day, "and those who scrutinized his calculations pointed them out as fallacious and absurd."

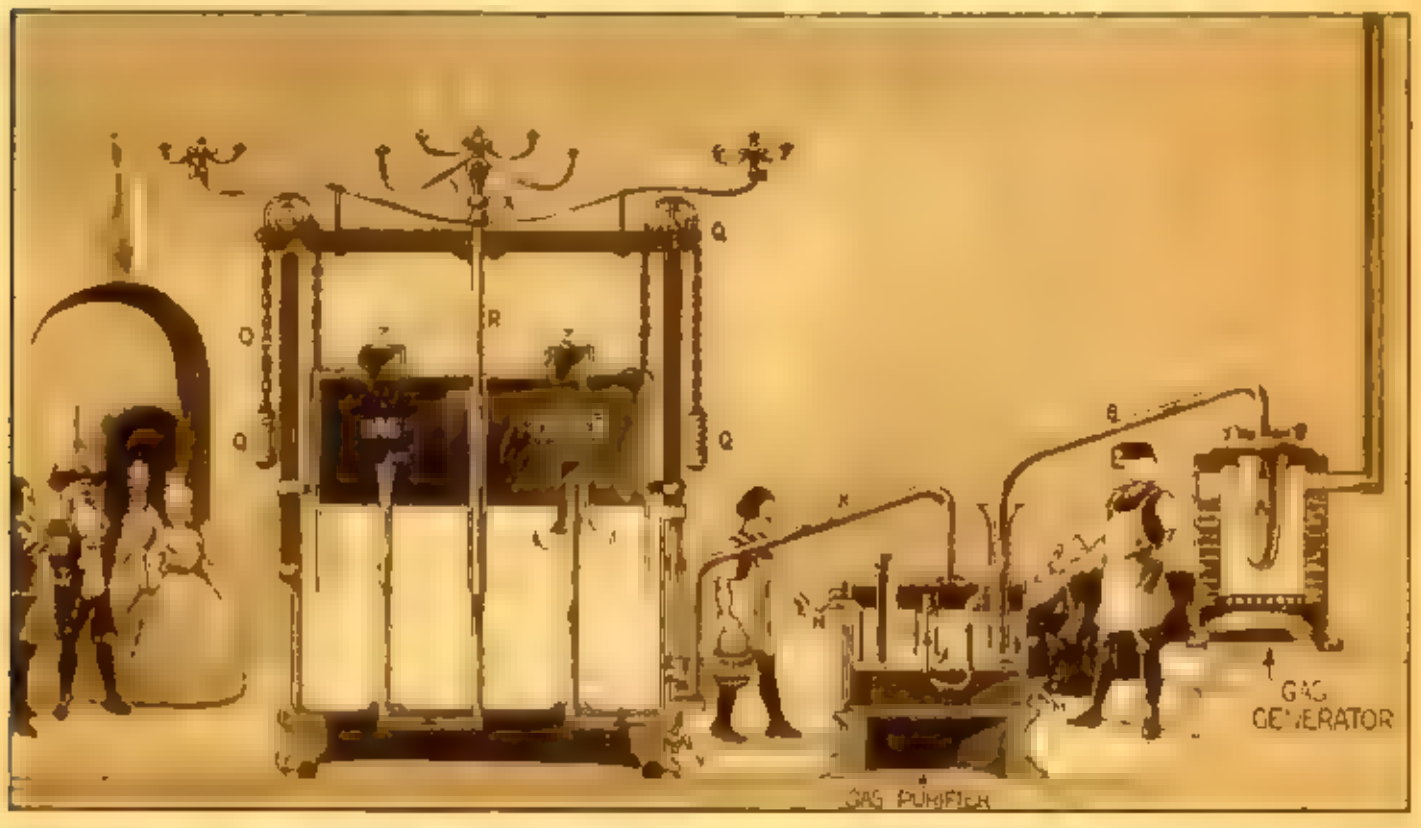
When we consider how Mr. Winsor's company in after years became a great organization, the attacks of the "yellow journals" of that time appear ridiculous. But they had very serious consequences for the inventor, and, what was even of more importance, they blocked the advancement of science for twelve years.

The London press was exceptionally vindictive in its attacks upon Winsor. "Circumstances will surely undeceive these subscribers," said one newspaper, "and prove the utter impossibility of realizing fallacious prospects. How often has the love of gain induced men to give a willing ear to the flattering and delusive tales of projectors?"

Said another, "His experiments have demonstrated to be most egregiously erroneous."

The grammar seems also to be erroneous.

(*Continued on page* 199)




The Above Cut Shows an Experimental Gas Plant of Ancient Days. The General Parts Are Described in the Article. The Gas Generator is Seen on the Right; the Next Object is a Purifier and the Gas is Purified by Lime, While Tar Collects in the Bottom of the Vessel, and is Withdrawn from Time to Time. Thence the Gas Goes into the Gas Holder at the Left, Which is Provided With Bonnets ZZ Over the Outlet Pipe and Counter Weights QQ. The Other Parts Are Self Explanatory, the Letters of Reference Being Reproduced from an Ancient Cut. A Very Interesting Feature of This 1810 Gas Plant is the Rat-Tail Burner, Several of Which Are Shown Lighted. This Was Before the Days of the Flat Flame Burner, Now in Use.

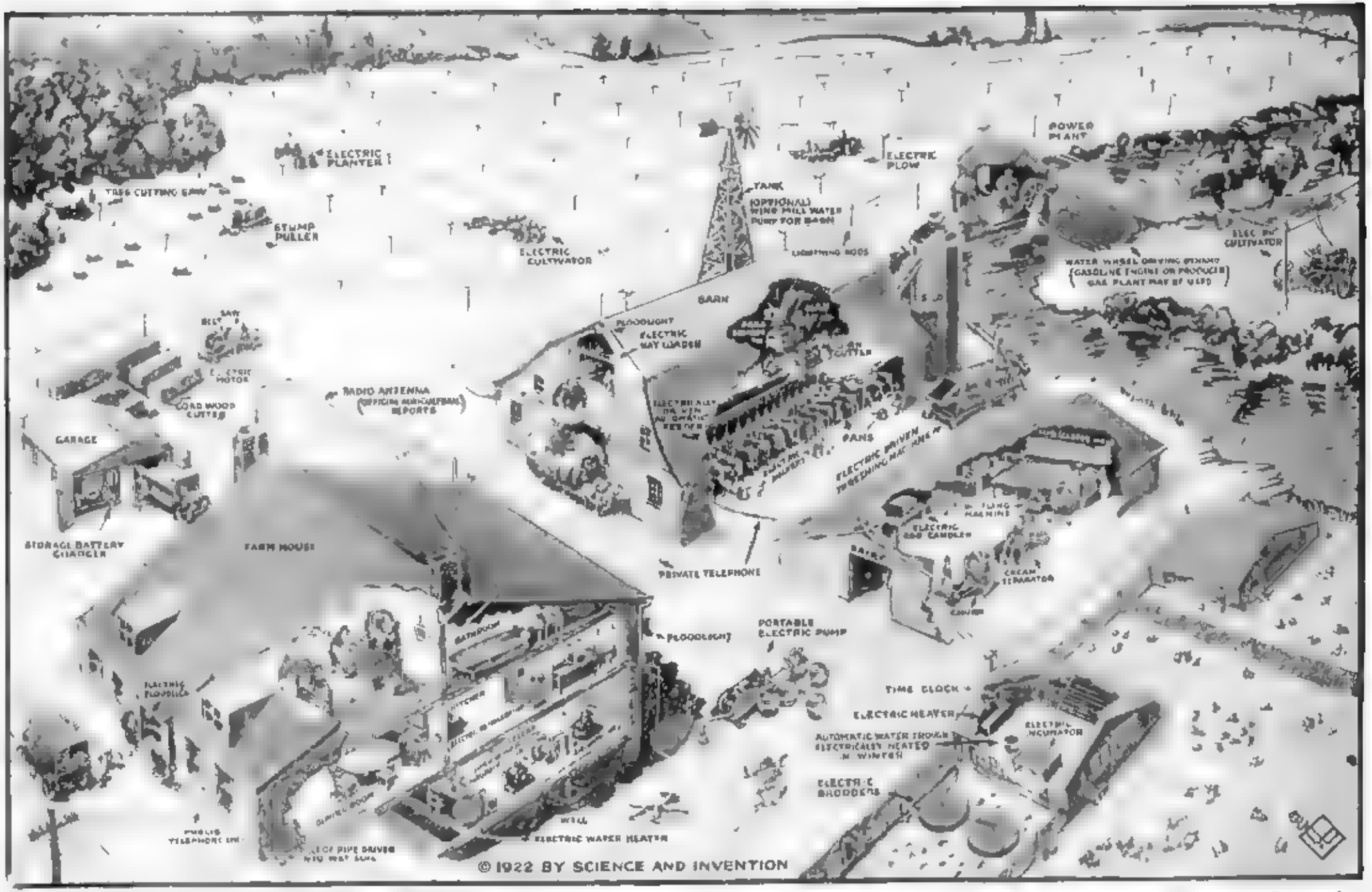
# Electric Farm de Luxe

By H. WINFIELD SECOR

THE accompanying illustration shows some of the more common electrical conveniences and utilities in use on many of our modern farms today. Electric plows, cultivators, and planting machines are not so commonly in use in this country as they are in Germany and several other foreign countries, but it will probably not be a great while before American farmers, especially where electrical energy can be purchased at low cost, as in the western part of the United States, in districts served by low-priced hydro-electric central station service, will be using these machines for tilling their fields.

The gasoline engine has come into very popular favor for driving tractors and other farm machinery, but owing to the rather high cost of gasoline today, and providing the scheme suggested by some of the country's leading engineers is put into practice, whereby the various groups of states may be served by a vast and highly efficient series of central station distribution systems, the one interlocking with the other, we shall probably see at a not very distant date electric power as the king of all powers on the farms, as well as in the cities. Electric power on the farm does its work well, for all of the motors and other apparatus used for performing every conceivable kind of work that the farmer has on his hands, operate at high efficiency with very little loss. We shall probably use gasoline propelled automobiles for some years to come, in preference to the electric storage battery type except where trucking is concerned, or for short distance runs, for the reason that the electrical engineers have not so far given us a storage battery which will carry the car more than seventy to eighty miles on one charge.

A farmer who wishes to electrify on a small scale can do so in one of several ways, and at a reasonable cost at that. He has the choice of at least three tried and proven methods of generating his own electric current, viz., 1—by using a water wheel or turbine to drive the dynamo; 2—by utilizing a wind-mill driven dynamo; 3—by employing a gasoline engine driven dynamo. Further than this it may be satisfactory from an economical point of view for him to purchase electric current from the local central station service when all of the costs of maintenance and repairs have been carefully computed for the first year or else for a few years. Gas producer plants suitable for small power production are available, and have a higher efficiency than a gasoline engine and dynamo plant. Where a great deal of wood is available for fuel, it is even possible that it would pay to use a steam engine and boiler to drive the dynamo. Most of [illegible] for [illegible] a [illegible] of [illegible] electric current [illegible] [illegible] [illegible]




Scene on the Electric Farm de Luxe — Electricity is Rapidly Becoming the Jack of All Trades About the Modern Farm — The Use of the Electric Current for Cultivating the Fields is Being Adopted More in Europe Especially Germany Than it is Over Here But This Application of Electricity to the Farmer's Needs is Dependent Mostly Upon a Low Known Hour Rate Where Central Station Supply is Depended Upon

# The Ray of Hercules

By RUSS SIMONTON

"ELEVEN hours!"

The speaker, a tall man with that faint stoop of shoulders which marks the scientist the world over, dropped the telephone receiver on its hook and sank into his chair at the table about which sat five others—the greatest scientists in America.

"Eleven hours!" he ejaculated again. "Hercules has sent his last warning. At noon tomorrow he will strike, he says, and annihilate every living being in New York. The wireless operator will hold the message secret as long as he can but the amateurs are sure to catch it and telephone the newspapers. This is our last chance to save the city from destruction."

Those familiar with the dignified and severe Horace Butler man of science would hardly have recognized the man as he leaned his arms on the table. His eyes stared into space as though they saw hidden, horrible things. Deeper than the gathered lines of anxiety at mouth and eyes, were the thin, cruel tracings, only produced by worry prolonged through sleepless nights and days of ceaseless thinking.

Every face about the table bore marks of the same character. These men were weary beyond ordinary endurance and yet held keyed and tense for action by the same agonizing emotions.

Gentlemen," Julius Grant, professor of physics of a great university, broke the painful silence which had followed Butler's words, "Gentlemen, eleven hours must be enough. Before noon tomorrow we must accomplish what we have failed to do in five days. Within this room are the scientific brains of America. We must we will—capture this fiendish madman and draw the fangs of his machine before they close about the city. Let us begin again. Can you think of no plan yet untried? You, Watson?"

Silently, a man at the far end of the table shook his head.

Oliver? Braithwaite? Johns?"

The weary, painful headshake of negation traveled from one to another around the table.

No matter how impossible it may sound Some plan," pleaded Grant, 'Coleman, suggest something."

He to whom the query was addressed spoke slowly.

"I have," he began. Instantly the eyes of all were upon him. Each man felt the stir of returning hope and hung breathlessly upon his words. "I have heard that a friend of mine has perfected a device that might help us. He is in New York. It is a wild hope, but—"

The interruption was from every side. "Send for him!"

Forty minutes later, James Dunwood, appearing fresh and dapper in contrast to the unshaven and weary men in the Hotel Vermont room, stood before them.

There were no greetings, no introductions.

Grant spoke at once. His voice was harsh as two bits of sandpaper rubbing.

Coleman has told us a little of your work and your discovery," said he. "You know, or must have guessed, the terrible situation which confronts us. For five days we have battled with a phantom horror. We have until tomorrow noon to find and render it harmless. Failing—not a living soul will be left in New York!

"Monday the Naval Radio Station received a wild radiogram, addressed to 'The People of New York,' and calling upon them to compel their mayor to distribute the funds of the city among the poor under pain of annihilation. Obviously the sender, who signed himself, 'Hercules,' was a crazy man and the newspapers wrote humorous articles about his bombastic message while the police made a casual and half hearted search for the unknown.

But each day since there has been a similar warning until today New York is quaking with a superstitious terror. What the people do not know, and what we are keeping secret is, that, on the day of the first warning, 'Hercules,' sent by radio to each of us here a message which proved to us that he has indeed the power to make New York a city of the dead."

He paused and lifting a paper from the table read it aloud.

"'Tell the people they must obey the master. Explain to them in words they

(*Continued on page* 190)

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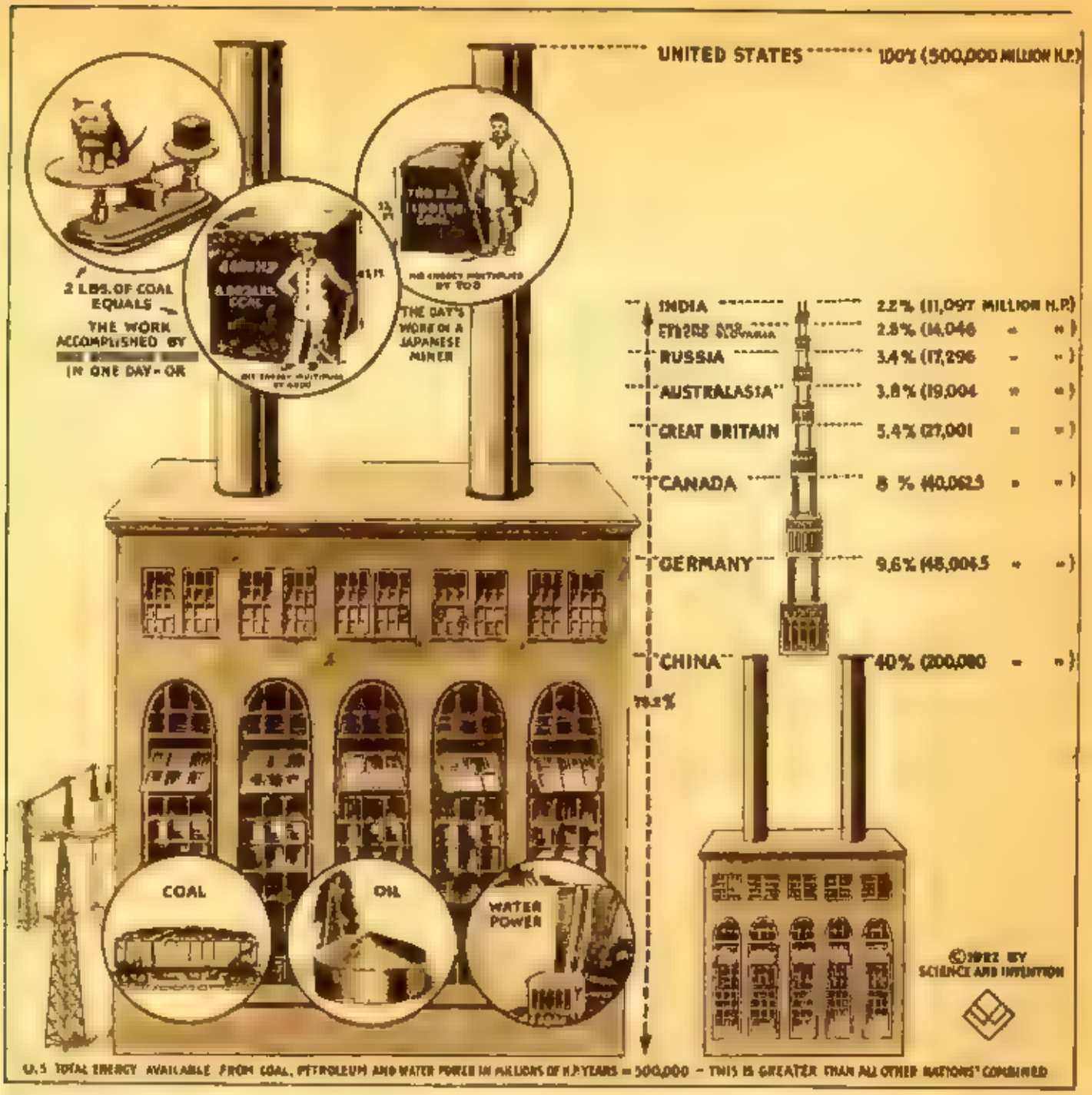
Coleman Slipped the Mask Over His Head and Took Up the Rubber Block with the Tiny Lever. "What Do You See?" Hoarsely Demanded Butler. "A Woman with Two Children Clinging to Her," Said Coleman. His Tones, a Little Distorted by the Mask, Seemed Unreal. "They Are Crying . . ."




No Other Nation Has the Energy Resources Possessed by the United States, According to the Calculations of a Scientific Expert, Whose Article Appears Below. All of the Energy Resources Combined of the Various Countries Cited at the Right of the Photo Diagram, are Equivalent Only to About Three-Fourths of That Possessed by the United States. The Figures Here Given Are for the Energy Resources from Coal, Oil and Water Power. There Are, of Course, Many Other Resources, Which Make the 75 Per Cent. Ratio for All the Foreign Countries Combined Many Times Smaller Than This Figure. The Small Inset Figures Show the Work Accomplished and the Equivalent Energy Available from the Coal Mined by An American and Also a Japanese Coal Miner. Two Pounds of Coal Give Approximately One Horse-Power-Hour, the Average Man Can Exert One Tenth Horse Power per Hour and So the Energy Available from Two Pounds of Coal When Burned in the Boiler of a Modern Electric Generating Station, Will Do as Much Work as That Performed by the Miner All Day

# U. S. Has Greatest Energy Resources

DR. THOMAS A. READ of the U. S. Bureau of Mines has reduced the power of the United States to terms of energy-resources and undertaken to prove that no other country is one-fiftieth as strong. He recently appeared before the student body of Georgetown University and expounded his deductions, saying:

"The real basis of power of a nation is its energy-resources, rather than its man-power strength. The modern way to use the energy of a man is to utilize it as we employ the little detonator of the big explosive shell, the little charge sets off the big one and does an amount of work far in excess of its own capacity.

"The power output of an average workman is about one-tenth of one horse-power. The energy expended by a coal miner in an eight-hour day thus amounts to about that available from two pounds of coal. A Japanese miner, who gets out 1,400 pounds of coal a day, thus multiplies his energy by 700. It is somewhat like planting one grain of wheat and having 700 grow from it. The American miner gets out 6,800 pounds of coal in a day and so multiplies his energy by 4,400.

"There are 41,000,000 wage earners in the United States, and their rated output is a little more than 4,000,000 horse-power, or only nine times the potential energy output in the form of coal of 100 miners. The power minerals, coal and petroleum, and water power are, therefore, the real sources of strength in an industrial civilization.

"Just where the United States stands on this basis is best brought out by some comparative figures which may be stated in millions of horse-power years. Taking the estimates of probable and possible available coal, petroleum and water power in the principal countries and reckoning

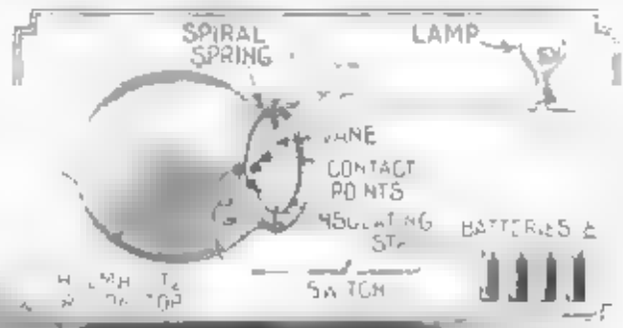
(*Continued on page 203*)

# Building a Color Organ

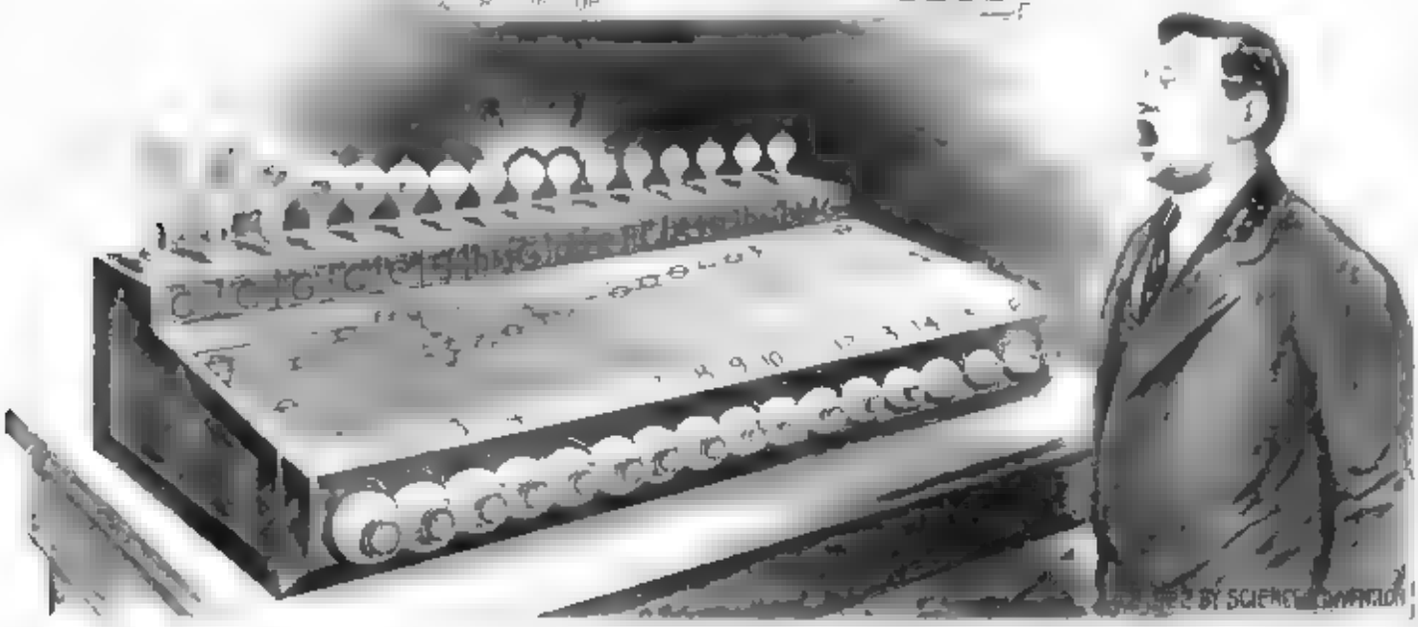
By MANUEL COMULADA

INSTRUCTOR OF ACOUSTICS, ARMY MUSIC SCHOOL, WASHINGTON, D. C.

The Experimenter Color Organ Is Very Interesting Apparatus Here Shown For the Experimenter With Explanations This Machine a Very Interesting One Indeed The Harmonic Resonator Responds to Certain Notes of the Scale and Lights Colored Lamps That Are Connected




The Diagram at the Center of the Illustration Shows the Lamp Circuit Together With Battery and Device by Which the Color Mounted on the Harmonic Resonator Causes the Corresponding Note



NEARLY [illegible]

friction like the violin or by striking as is the case with piano strings.

The position, number and relative intensities of these partials present with every [illegible] musical instruments. The [illegible] softly played has very few of partials present hence the suavity of [illegible]

ery high sounds are produced in the upper register of this instrument there are prac[illegible]

On the other hand if we blow an oboe [illegible] sounds are very rich and of a decided and [illegible]

be real hence the peculiar sound given by [illegible]

me is but are unable to know how many [illegible]

ment to [illegible]

e the Har[illegible]

ble to solve

## The Harmonic-Tone Shows Notes and Harmonics Sounded

this very same problem. A saxophone player wishes to know how many overtones or partials he produces with a particular sound and tone color, the instrument is blown directly in front of the Harmonic-phone which is tuned to correspond with the period of vibration of the fundamental

test the fundamental as well as the overtones present are received by the diaphragms [illegible]

By securing a standard scale set of [illegible] employed as a tone type color organ, the [illegible]

notes or fractions [illegible]

rieties secured and mounted on a piece o[illegible]

sever[illegible]

In the whole resonators there is a tendency for a vane placed across the mouth to assume a position parallel with the [illegible]

for each particular musical instrument a different harmonic-phonic would have to be [illegible]

off the duplicate set and a little more off [illegible]

possibility of locating the harmonics and [illegible]

[illegible] copy of the patented photograph which describes an electro-[illegible] produced by sound [illegible]

U. S. patent No. 1,390,768

When the flute, violin or other instrument is played each individual or fundamental note will effect the attuned resonator and the vane in the mouth of the resonator will close forming a circuit between the two points on the vane and [illegible] thus lighting the lamp con[illegible]

# The Smell Organ

By JOSEPH H. KRAUS

In Our May Issue We Described the Latest Idea in Color Organs and Now We Have the Pleasure of Introducing the Newest Noiseless Organ—It Delights You Not With Wonderful Rhapsodies in Sound But With Wonderful Musical Combinations Expressed by Delicately Graduated Odors. Dr. Septimus Piesse a French Chemist is Sponsor for This New "Smell Organ," and He Has Worked Out the Elaborate Scale of Notes and Corresponding Odors, Which Are Shown Marked in Their Proper Positions on the Musical Staff in the Illustration Above. Out the Right is a Musical Composition Combining Harmonious Scents in the Form of Chords

# A Vacation-Time Radio Receiver

By ROBERT E. LACAULT

A REAL radio fan cannot conceive of a vacation without a radio set. This is particularly true in my case and ever since I listened to radio signals with the aid of an electrolytic detector, since 1910, I have never failed to carry with me some form of

standard dry cells in the A battery compartment of the cabinet, to furnish the necessary filament current for the tubes. The plate voltage is obtained from two 22½ volt B batteries of small size.

Figs. 1, A, B, C show the front panel and a sectional as well as a top view of over a length of ½" as shown in Fig. 6B. Another stick 19" long should be provided with small holes beginning ¼" from one end and spaced ½" from each other as shown in Fig. 6A. In each of these holes a pin or nail may be pushed to adjust the tension of the wires in the loop.

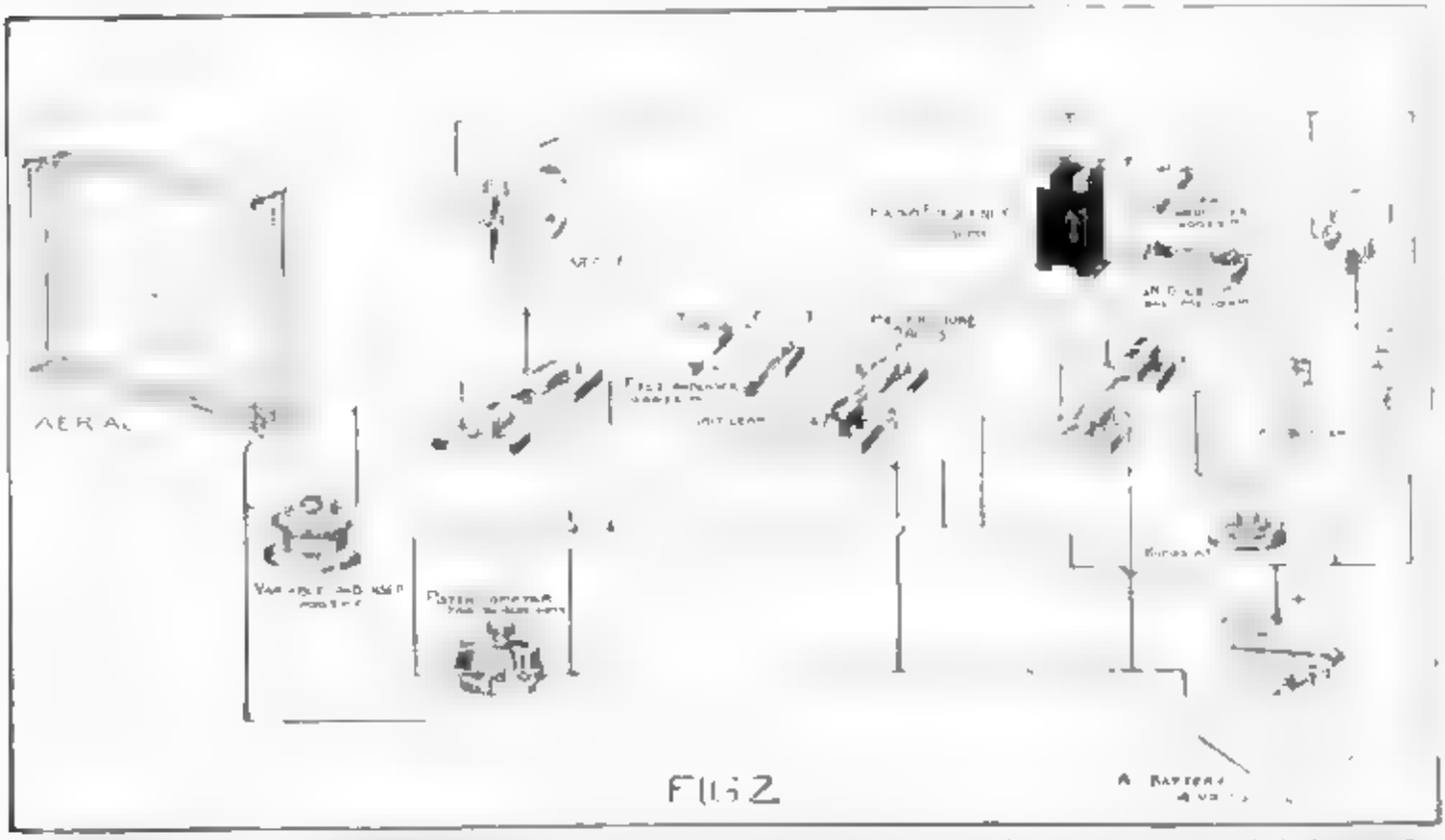



FIG 2

Perspective Diagram Showing All the Connections to the Terminal Posts of the Various Radio Instruments Used in the Vacation-time Radio Receiving Set Here Described by Mr. Lacault. This Set Employs a Small Loop Aerial, as the Front Cover Illustration and Diagram Below Show. This Loop, Being Shunted by a Variable Condenser for Tuning to Different Wave Lengths. The Amplifier Comprises Two Stages of Radio Frequency, With a Radio Frequency Transformer Connected as Indicated in the Diagram. Three Vacuum Tubes Are Used. These Operate on Four Volts Filament Potential, Which May Be Supplied by a Two-Cell Storage Battery or Five Dry Cells. The 'Phones Used Should Have 2,000 to 3,000 Ohms Total Resistance for the Set

radio set during all my vacations. This year intending to visit many points, and wishing to carry as little baggage as possible I designed the compact and efficient little receiver described here. With it is used a loop aerial which may be folded so as to take up a minimum space and avoid the necessity of installing an outdoor aerial which takes too long a time and is not always easy to construct. I hope this may be of some value to amateurs.

The wave-length range of this outfit covers from 180 to 500 meters, which is the most interesting scope since it includes the wave length of both amateur and broadcasting stations. The receiver consists of a loop aerial shunted by a variable condenser, a regenerative effect being obtained by means of a variometer connected in the plate circuit of the first amplifier tube, as shown in the diagram, Fig. 2. The amplifier comprises two stages of radio frequency, one using iron core transformers such as may now be obtained at any radio shop. In order to save space and weight, small vacuum tubes are used. These require four volts on the filament supplied by means of a small storage battery having the electrolyte rendered unspillable by the addition of proper absorbents, glass wool etc. Such small batteries are used in medical apparatus and in portable lamps. In case one prefers to use dry cells, he may do so by mounting four

the cabinet with the various parts composing the receiving set and the amplifier. On the top of the panel are the three tubes and below may be seen the knobs of the rheostat and potentiometer. The two dials are those of the variable condenser and the variometer. The radio frequency transformer, grid leak and grid condenser as well as the coupling condenser are mounted on the back of the panel and also on the top of the cabinet. The special compartments for the "A" and "B" batteries are screwed thru the sides of the cabinet as shown in Fig. 1B and should be so fixed as to exactly accommodate the battery to be used. The whole outfit which is 5" inches wide takes little room in the suitcase which may be used also to carry clothes and other necessary accessories of every vacationist, as may be seen [illegible] illustration on the cover of this [illegible]

## The Loop Aerial

After designing several types of folding loop aerials, the one shown in Fig. 6 was considered to be simplest and best adapted for the purpose. It consists of eight pieces of round stick 1" in diameter, four of them being 18" long and provided at one end with a piece of brass tubing into which they fit tightly. A small [illegible] passed thru both to prevent the latter from sliding back. The other sticks 18" long should be turned down to ½"

and also to permit the erection of the frame and the mounting of the winding. In the center where the two arms of the frame meet a cross-piece of brass tubing supports the sticks. This cross piece may easily be made by soldering three lengths of tubes together, if it is not possible to buy it ready made in a hardware store.

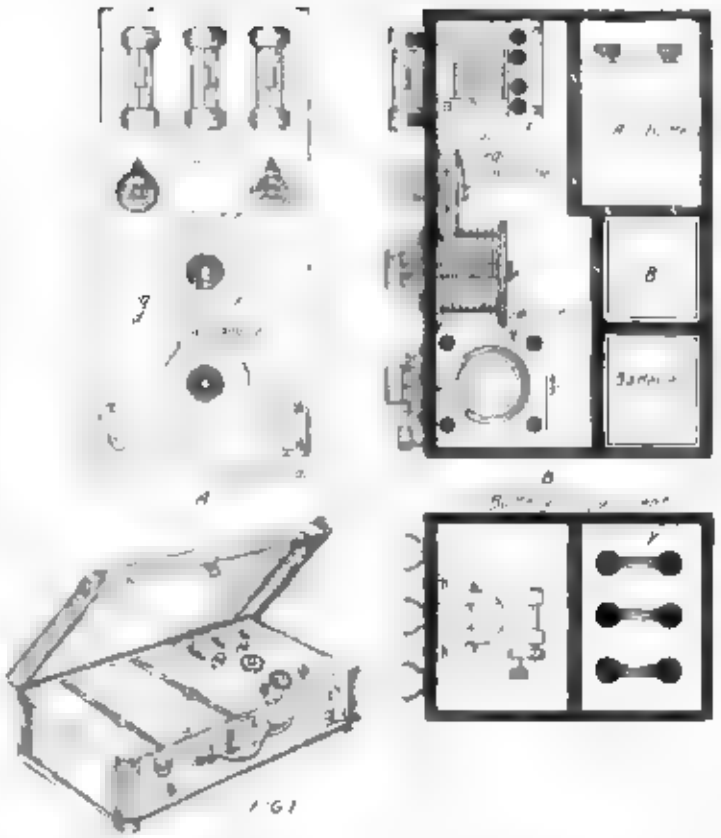
To obtain best results with a loop aerial for the reception of short wave lengths the wire should be wound with a space of about 1 inch between the turns. In order to keep this spacing and at the same time to permit the rapid removal of the complete winding the following scheme was devised. The wire is clamped at each corner of the loop between two strips of bakelite or other insulating material, so that the complete winding may be folded to occupy little space and at the same time to retain its shape. The size of the bakelite strips is shown in Fig. 4. Five strips should be provided with a 1 inch hole in the centre so as to pass over the ends of [illegible] and [illegible] proper tension.

At the four corners of the loop the bakelite strips supporting the winding are stopped by the small piece provided at the end of the sticks, while at the fourth corner the strips may slide down along the stick. When the first three pieces are in place the fourth is pushed up to the end

of the stick provided with holes and the pins passed thru one of these to obtain the proper tension of the wire and keep the bakelite end pieces in place as shown in Fig 5. The insulating strips are clamped together by means of screws and nuts, when the wire has been set in place. On one of the end pieces two of the screws should be replaced by small binding posts.

The best wire to use for the winding of the loop is flexible stranded conductor of small diameter which may easily be wound around a piece of cardboard without breaking, as stiff wire would. The easiest way to wind the loop before clamping it is to set up the frame first and prepare the necessary bakelite strips and screws, the end piece sliding along one of the sticks is stopped by the pin inserted in the hole nearest to the center. Only two of the screws fixing the strips together should be set in on one side, loose enough to enable the wire to be inserted between the strips on the other side as shown in Fig 7. When two turns are made on one side the two screws are screwed in the holes and the others removed. The winding of the two [illegible] being properly spaced and adjusted when the four turns are all in place.

As may be seen in the diagram only a hot rheostat is used for the amplifier tubes as this is not necessary with the type of tube used. A potentiometer regulates the potential applied to the grids thru the loop winding. The rheostat for the detector tube is not absolutely necessary, a little of sometimes improves the reception. The variometer used in the plate circuit of the first tube is a standard one which I built by the amateur himself should have 50 turns on the rotor and 50 on the stator of No 22 [illegible] winding. In order to save space on the panel the mountings for the Moorhead tubes were removed from the [illegible] and fixed upon the panel itself.







The Set as Built by the Author. Dr. Corbett at the Side of the Panel. Below, Left, Front Side and Panel View. The Panel Would Be Set Out and Have on It the Apparatus Mounted, Should Be Made of Bakelite or Fiber

FIG 1

In the Diagram Giving a Key Showing the Various Parts of the Set, With the Values of the Condensers and Other Elements. Two Stages of Radio Frequency Amplification Are Used Before the Detector, Providing Considerable Selectivity and Sensitiveness, Giving Loud Signals from the Loop Aerial. Data Table [illegible] Outdoor Antenna [illegible] Of Course

the necessity of the signals heard in the telephone is not as strong as if two steps of audio frequency amplification were used after the detector without any radio frequency amplification before, but the [illegible] in the second case is [illegible] than in the first.

When building the set it will be found the easiest way to make the layout of the panel is to first trace on a piece of paper the dimensions and spaces of the various parts and positions of the screws. This paper may then be stretched and fixed over the bare panel and the various holes drilled thru both, observing the proper spacing for the screws. The paper may then be removed and the rheostats, condenser and other instruments mounted and wired. No dimensions are given in the sketch showing the set as this depends upon the particular suitcase in which the receiver is to be installed. It is best to have a panel built as a separate unit and fitted in a cabinet with a handle on [illegible].

In conclusion I would say that with such a receiver signals from amateur stations about 200 miles distant have been received quite often while broadcasting transmissions from broadcasting stations have been picked up quite clearly at a distance of almost 400 miles.

Where the experimenter may wish to use an outdoor aerial instead of a loop he will of course gain greatly in the range over which he can receive. An aerial 100 feet long using one or two wires will work with this set. A piece of fine magnet wire will do for a temporary aerial. Tying a string to one end of it and a stone or other weight to the free end of the string. The stone is then thrown over a high tree limb, carrying the string with it and the aerial wire can then be pulled taut. Insulators such as a porcelain cleat or two should be placed between the cord and antenna wire. The lower end of the antenna may be connected directly to the receiving set or else be anchored with an insulator to a peg or other object. A fine wire dropped out of a hotel window would also serve as a temporary aerial using a steam or water pipe for a ground connection.

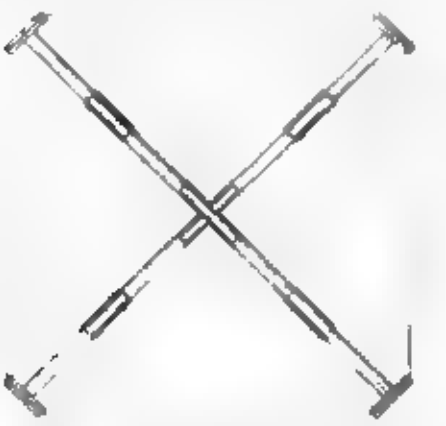


FIG 6

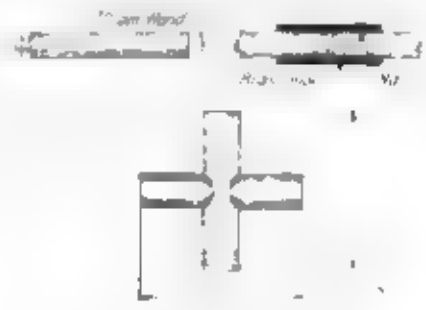


FIG 3

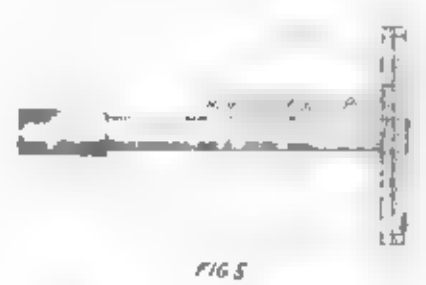


FIG 5

FIG 7

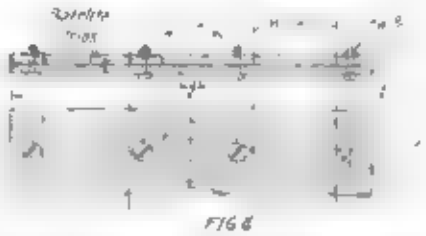


FIG 8

Details of Construction for the Loop Aerial to be Used With the Vacation-time Radio Set Are Given in the Drawing Above. A Series of Holes Are Drilled Thru the End of One of the Cross Sticks so That the Aerials May be Pulled Tight and a Nail Inserted Behind the Spreader on That Particular Leg to Hold the Wires Taut

July

25 cents

# Science and Invention

TELEVISION BY RADIO

# Unique Double-Deck Subway

A FEW months ago or, to be exact, in the April issue an article by H Gernsback appeared, describing his plan for double decking the cars in the larger [illegible] heavy [illegible] those in New York where the traffic conditions are [illegible] the hours, and now comes Bernarr MacFadden, well known New Yorker, who has taken out a patent on a unique double-deck subway car system, which is shown in the accompanying illustration.

Mr MacFadden has brought out several ingenious ideas to permit the building of these double-deck subway cars in such a [illegible] and to get the greatest [illegible] level of the subway cars now in use is about 4 ft high above the tracks, and thus a lot of space is wasted compared to the system here shown where the seats are [illegible] under the seats as indicated in the sectional view clearly [illegible] The inventor points out that not only the height of the cars over the tracks can be made the same as in the present subway cars, but the center part of the car floor can be lowered [illegible] inches, thus giving [illegible] headroom in the center of the car. The folding steps may be [illegible] the car and just under the upper deck doors, are for use at [illegible] stations to permit passengers to ascend and descend decks, while passengers desiring to pass to the lower car doors may do so via the folding [illegible] shown [illegible] As the car leaves the station where these steps have been in use, the motorman pulls a lever [illegible] causes them to collapse and fold up [illegible] the steel partitions, as the [illegible]

No doubt with this system a greater number of people can be handled than might at first be imagined, particularly when the double [illegible] is brought into play. The upper ramp or inclined platform serves the two or more doors opening on the second car deck, while the [illegible] four doors on the lower deck. The [illegible] the [illegible] of the [illegible] [illegible] the [illegible] [illegible] [illegible]

# Can the "Lusita

THE VIEWS OF LAKE, WILLIAMSON LEAVITT

By JOSEPH

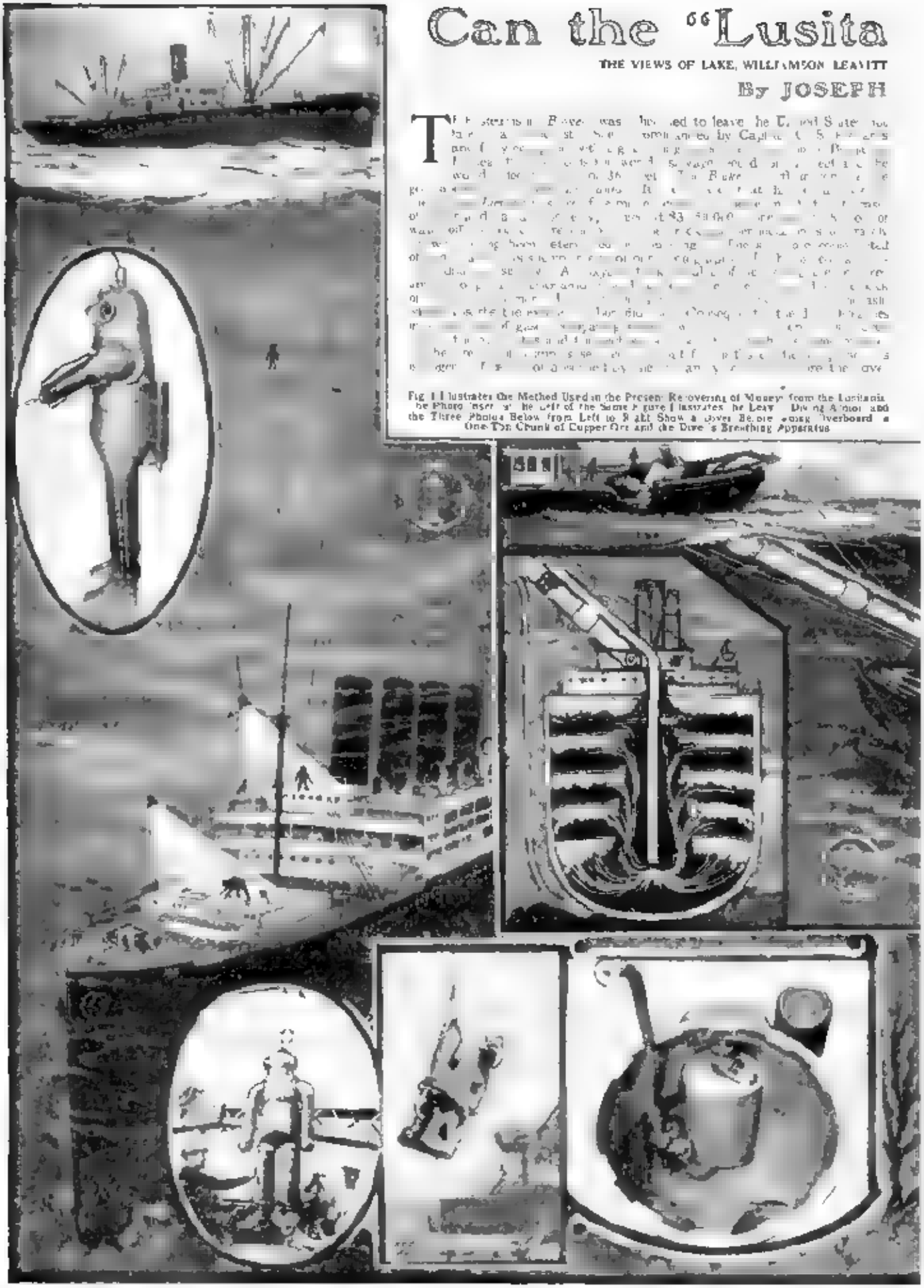


Fig. 1 Illustrates the Method Used in the Present Recovering of Money from the Lusitania. The Photo Inset at the Left of the Same Figure Illustrates the Leav Diving Armor and the Three Photos Below from Left to Right Show a Diver Before going Overboard a One-Ton Chunk of Copper Ore and the Diver's Breathing Apparatus

# nia" Be Raised?

AND OTHER EXPERT SPECIAL INTERVIEWS

H. KRAUS

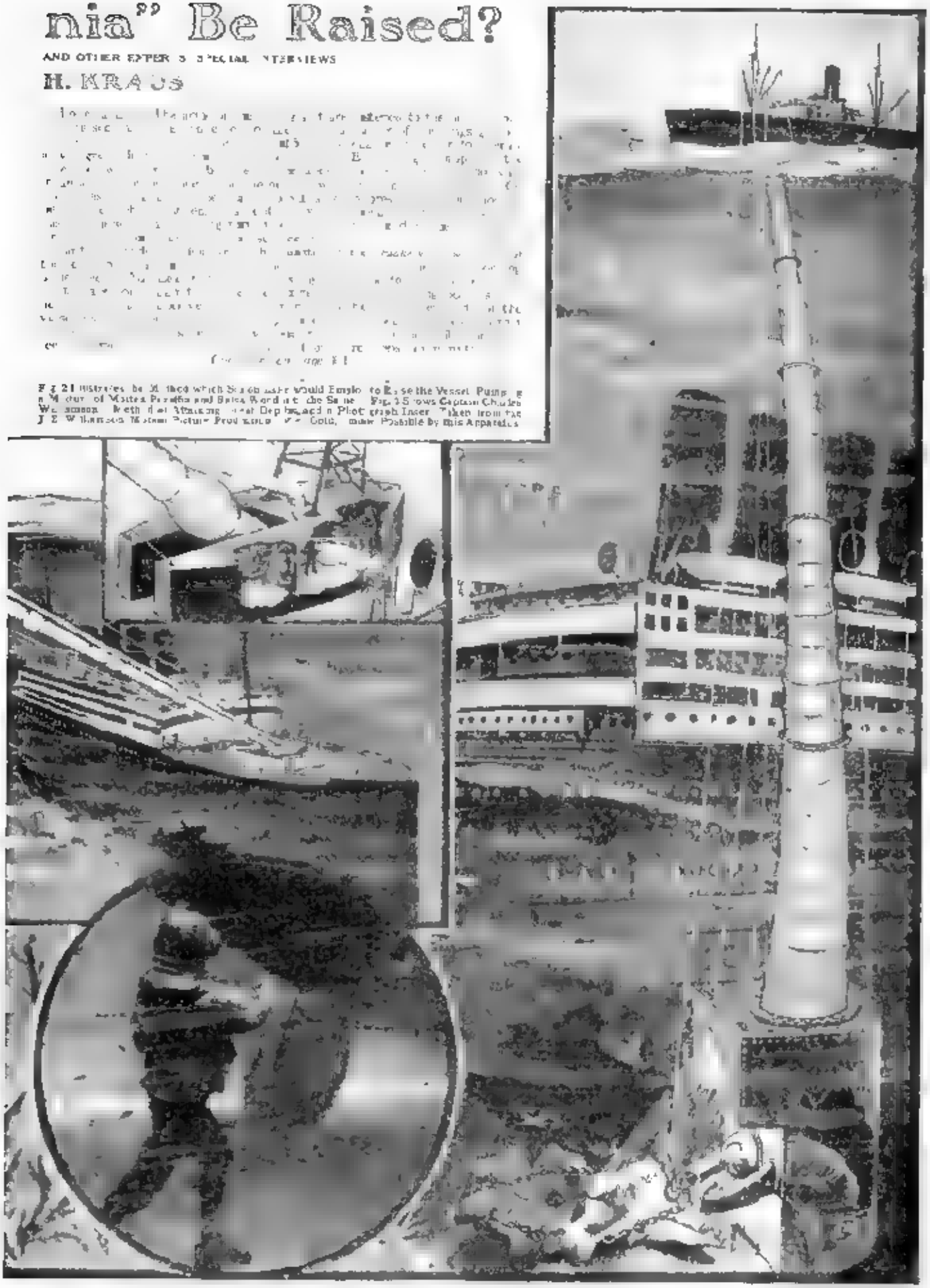
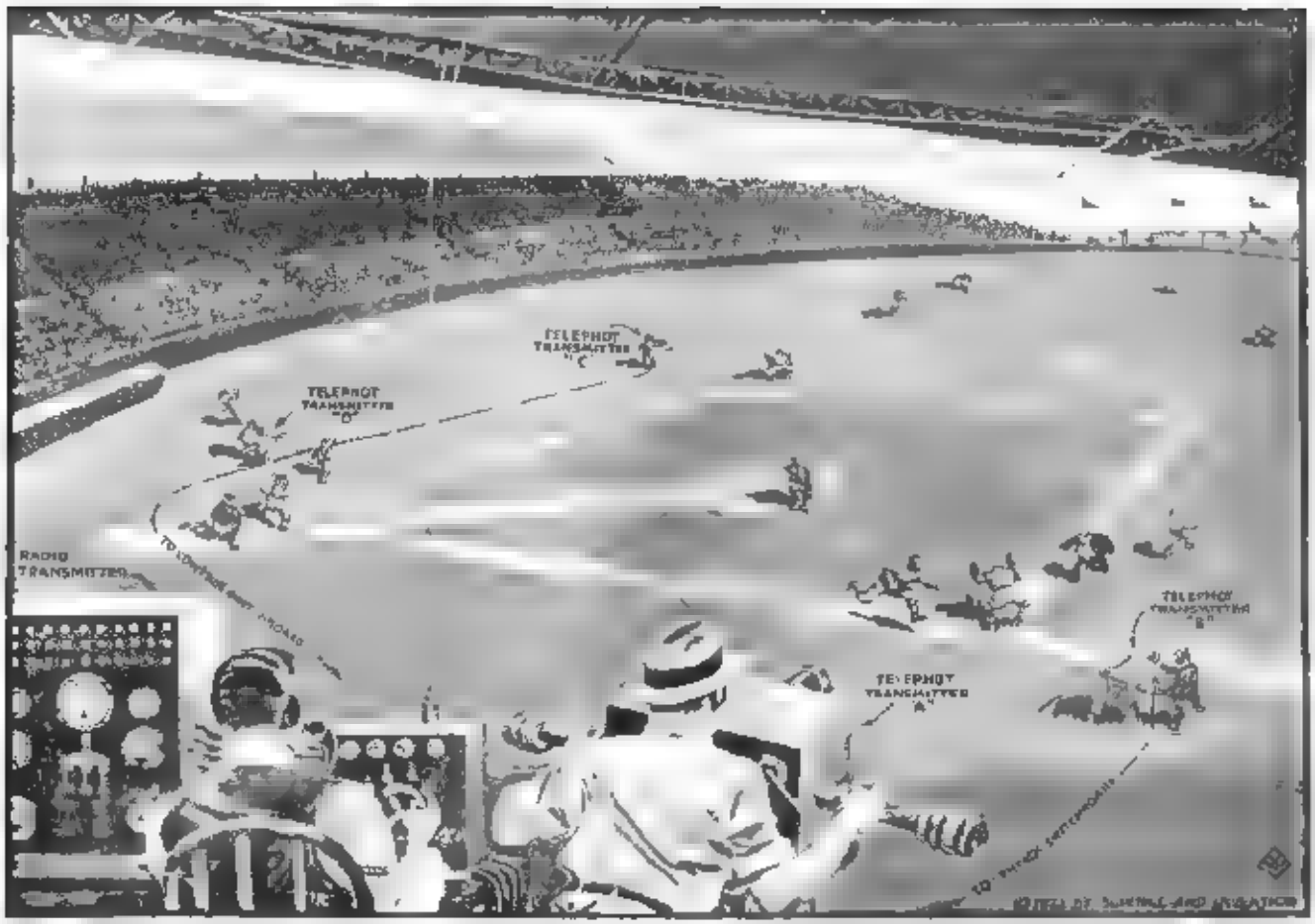


Fig. 2. Illustrates the Method which Scientists would Employ to Raise the Vessel. Putting a Mixture of Molten Paraffin and Beta Naphthol into the Same. Fig. 3 Shows Captain Charles Wilkinson with the Working Gear Employed in Photographing Inset Taken from the J. E. Wilkinson Motion Picture Production "The Gold Made Possible by this Apparatus




In This Illustration We Behold How Future Audiences Will See a Baseball Game Thousands of Miles Away. Here We See a Common Radio Transmitter to Which Are Connected Several Telephot Transmitters. The Operators of the Telephot Transmitters, A, B, C and D, Shoot the Interesting Parts of the Game. But They Do Not Do This Simultaneously. They Merely Point the Telephot Transmitter in Focus While the Radio Operator at His Instrument Switches from One to the Other. In Order to Get Those Close-Ups Which He Wishes. The Distant Audience Then Will See Whatever Close-Ups Are Selected by the Radio Operator. It Naturally Would Not Do to Have Just One Telephot Transmitter, for the Reason That at Times the Operator Would Be Either too Far or Otherwise too Close to the Scene. By Having a Multiplicity of Telephots This is Avoided

# The Radiophot. Television by Radio

## Coming Inventions. No. 7

By H. GERNSBACH

MEMBER AMERICAN PHYSICAL SOCIETY

SCHEMES on television are not new. Inventors have busied themselves for several generations with this invention, but so far nothing of note has been produced. The writer, in the May and June, 1918, issues of the ELECTRICAL EXPERIMENTER discussed various ideas on television and showed what had been proposed by inventors heretofore. There are many patents in existence referring to the *radiophot* (*tele=far, photos=light*). But so far there has been no inventor who actually was able to demonstrate a continuous view of a moving object by electricity at a distance.

It is not that it is impossible to do this, but the great cost of such an apparatus has been prohibitive. Furthermore, one of the greatest stumbling blocks is that in nearly all schemes shown in the past, it was necessary to have hundreds and even thousands of wires between the sender and the receiver. If, for instance, we wish to talk to our friend five hundred miles away over the wire all we need is a single wire, or two at the most, if we do not wish to use a ground or return circuit. If with the schemes proposed heretofore, we wish to see our friend at a distance it means that we would have to string several hundred wires between the two points and the idea for this reason becomes at once impractical.

The author in this article proposes a somewhat more ambitious scheme of television not only over wire, but by radio. He wishes to state in advance that no apparatus has been as yet constructed along this line, but it is believed that the scheme here shown has possibilities that would seem inviting to our constructors who wish to take the time and trouble to build such an apparatus. Engineers are of the opinion that an apparatus of this kind will actually do the work with perhaps a few minor improvements.

The stumbling block with former telephots or television schemes usually was found in the selenium cell. This was so for the following reasons. When we desire to project a picture at a distance, it is first necessary that we have some instrumentality which changes the intensity of the electric current in the same ratio as the intensity of the light that falls upon the instrument changes. A picture, as is well known, is made up of various points. Pick out any half tone illustration in this journal, view it under a magnifying glass, and you will see that it is made up of light and dark dots. The dark dots give the picture its dark tones and the light dots give the half-tones and the white paper shades in comparison with the dots.

The selenium cell has long been thought the best instrument to translate changes in the intensity of light into electrical current impulses. Imagine a screen made up of several thousand selenium cells. A picture falling upon this screen will thereby resolve itself into the various components of the picture itself. Then some selenium cells will receive more light, others less, etc.

The electrical impulses are then sent out over the wires to be reconstructed later into a picture at the receiver. The trouble with the selenium cell is, however, that it is sluggish. In other words, the selenium cell takes a large fraction of a second in which to change its resistance. Light is instantaneous, and all reconstructed selenium pictures are always lagging behind. If we actually could obtain a reconstructed picture, it would be imperfect.

This trouble is done away with in the author's radio television scheme whereby instead of the selenium cell we make use of photo-electric cells. There have lately developed a number of such cells, which are invariable and which are highly light sensitive. Moreover, they are not sluggish in action as are selenium cells. In other words, *they vary their resistance almost instantly* as the light falls upon them, or as it is removed.

Referring to our main illustration, the author's scheme resolves itself into the following. At the transmitter we have an ordinary camera. Before the back of which we have a great number of tiny photo-electric cells. Each cell responds according to the strength of light and shade. The lens in front of the camera picks up the view and throws it inverted upon the group of photo-electric

...parts of the ... the baseball ... light ... of his body, as for instance the ... affect only those cells upon ... These cells then send their impulses into a vacuum ... modulator and synchronizer. This valve ... modulator is a regulation radio ... tube, and each of these vacuum tubes sends out its own wave. For instance, photo-electric cell number one will send out on a wave, let us say, of 500 meters, photo-electric cell number two transmits on a wave of 500½ meters, photo-electric cell number three sends out on a wave of 500¼ meters, and so on down the line.

From the radio transmitter all of these waves are sent out from one and the same aerial, which is quite feasible, for it has been demonstrated years ago that one aerial can be used to send out many messages, each on a different wave length, and there is no trouble in doing this very thing today. To examine what we have done in our transmitter: We have transformed light impulses ... wave lengths, ... its own identity.

Now let us see what happens at the ... The distant aerial picks up all the different waves on a regulation radio receiving ... to tune very sharply, otherwise, it will not be possible for us to receive a clear picture.

In our television receiving box proper, we have the following. There is a bank of inductances with their respective condensers, together called the wave analyzer. These inductances and condensers are tuned circuits, and each picks out its own wave length ... circuit, each inductance and condenser, we have also an audio frequency amplifier, which operates ... electro-magnet, similar to a telephone receiver. The wave analyzer is not a new invention at all. Any amateur radio operator knows that he can tune in or cut almost any wave length that comes along, within reason. It is also possible by means of certain arrangements to tune in several pieces ... broadcast concerts from different stations, all on the same outfit. This already has been accomplished.

Coming back to our wave analyzer, let us see what happens now. Inductance number one, condenser number one, and audio frequency amplifier number one, are tuned to a wave length of 500 meters. This circuit, therefore, will respond only to 500 meters wave length, and to no other wave. Consequently, when at the distant sender photo electric cell number one is energized, it sends out a wave at 500 meters, which wave is ... only ... number one, and audio frequency amplifier ... one. All the other ... circuits, condensers, and amplifiers are not affected because they work on different wave lengths.

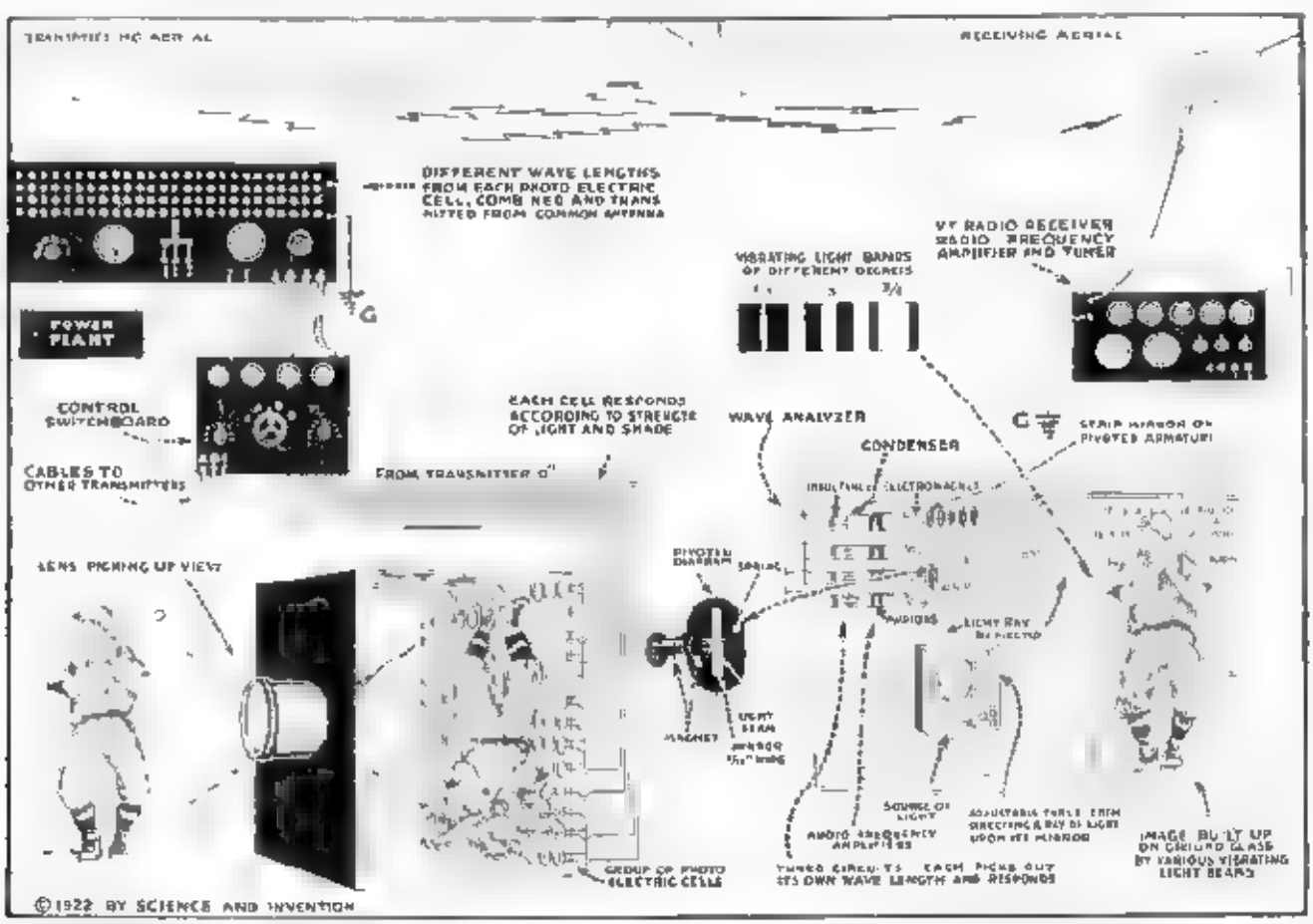
We shall now see how the picture is reconstructed. The electro-magnets are so fixed with each of the many audio frequency amplifiers are equipped with pivoted diaphragms in the center of which are mounted vertical strips of mirror which are very narrow. These mirrors may be 1/16th of an inch wide, or thereabouts. The best width will probably be found by experimenting. From a common source of light also ... a single ray of light falls just outside of each mirror. See diagram. The common source of light may be a powerful tungsten lamp enclosed in a box or furnace with many holes. Each hole lets a ... light ray shine out ... in a series of rays of light upon a ground glass screen.

The instant that the audio frequency amplifier energizes the electro magnet the diaphragm in front of it begins to turn on its axis and reflects the normal ray ... begins to vibrate back and forth. This ray of light falls upon a ground glass plate in the rear of the receiver.

At this point we wish to call the readers attention to the fact that the diafram in front of the electro magnet is not the ordinary telephone diafram but is one that is pivoted. In other words, the more current flows in the electro-magnet, the more the diafram will turn. Of course, this diafram is attached in such a manner that it will not turn more than a great angle. A small fraction of a degree is sufficient. It can be ... only a minute angular measurement or less ... beam of light that plays on the ground glass will move for quite a distance.

If the diafram vibrates violently ... flat piece of light will illuminate a square ... on the ground glass. This is ... experimentation. If the diafram does not

(Continued on page 290)




This Shows the Method Operandi of the Latest Proposed Telephot Scheme. First We Employ a Group of Photo-Electric Cells Which Are Light Sensitive, and Which Transmit Light Impulses into the Radio Transmitter. Whenever Light Falls Upon the Photo Electric Cells, These Cells Transmit an Impulse. Where No Light Falls as at the Shadow of the Bucchal Player Such a Photo-Electric Cell Remains Dark and Consequently Sends Out No Impulse. All the Cells Send Out Impulses Which Are Transmitted at Different Wave Lengths from a Common Transmitting Antenna. These Are Picked Up at a Distant Receiving Aerial. Where We Have Also an Instrument Which Consists of a Great Number of Inductances, Condensers, Audio Frequency Amplifiers, and Electro-Magnets. Each Such Unit Responds to a Certain Wave Length. In Front of the Electro Magnet, Which Is Energized We Have a Pivoted Diafram. On the Diafram We Have a Narrow Mirror. When the Diafram is at Rest, the Light Beam Falls Upon It, and Just Misses the Mirror. The Slightest Vibration of the Mirror However Intercepts a Light Beam From a Common Source Which Light Beam Plays Upon the Ground Glass. The Combination of All These Diaframs a Reflecting Each One a Light Beam, Reconstructs a Picture on the Ground Glass as Shown

# A Tunnel Through the Earth!

**By CLEMENT FEZANDIE**

WHAT would happen if a tunnel were bored through the centre of the earth to the other side, and a passenger allowed to fall thru in a suitable car?

Most persons would answer "The car would fall to the centre of the earth and stay there!" This answer is wrong. Others would say "The car would fall to the centre of the earth, with gradually increasing speed, until it reached the centre and there its acquired velocity would be so great that it would go straight thru to the other side of the earth before stopping."

This answer would be correct if the tunnel were bored thru the axis of the earth, from the North Pole to the South Pole, but such a tunnel would be of no use, as there are no passengers or merchandise to be transported from Pole to Pole. If a tunnel were bored in any useful spot, say from Australia to New York, neither car nor passenger would ever reach the center of the earth, except in the form of a gas!

Again the question arises as to what would be the effects of gravitation on the passengers in the car. Most people would claim that he would have his full weight at the start of the journey, and that his weight would gradually diminish until, at the very center he would weigh nothing at all, and then his weight would begin to increase again. This answer is altogether incorrect.

Then there is the question as to whether, when gravitation ceased to act, the objects in the car would attract each other—whether, for example the chairs would follow the passenger around as iron follows a magnet. Sir Isaac Newton gave the answer to this problem in his "Principia" but I doubt if many readers could give the correct answer off-hand.

An allied problem arises as to whether a body without weight can be thrown any distance. Give a baseball pitcher a feather to throw, and he will be unable to throw it more than a few inches. If it had no weight at all, could he throw it a single inch?

Similarly the passenger in the car, while retaining his full muscular force, tries to jump from the bottom of the car to the top. If he has no weight would it be possible for him to jump a single inch against the resistance of the air which we suppose to be in the car?

Another question: "If the passenger can normally lift a weight of one hundred pounds, what is the limit of his lifting power when objects have no weight at all?"

Other interesting problems are the time required for the body to fall thru the earth and the greatest velocity it would obtain, and what sensations the passenger would experience during the descent.

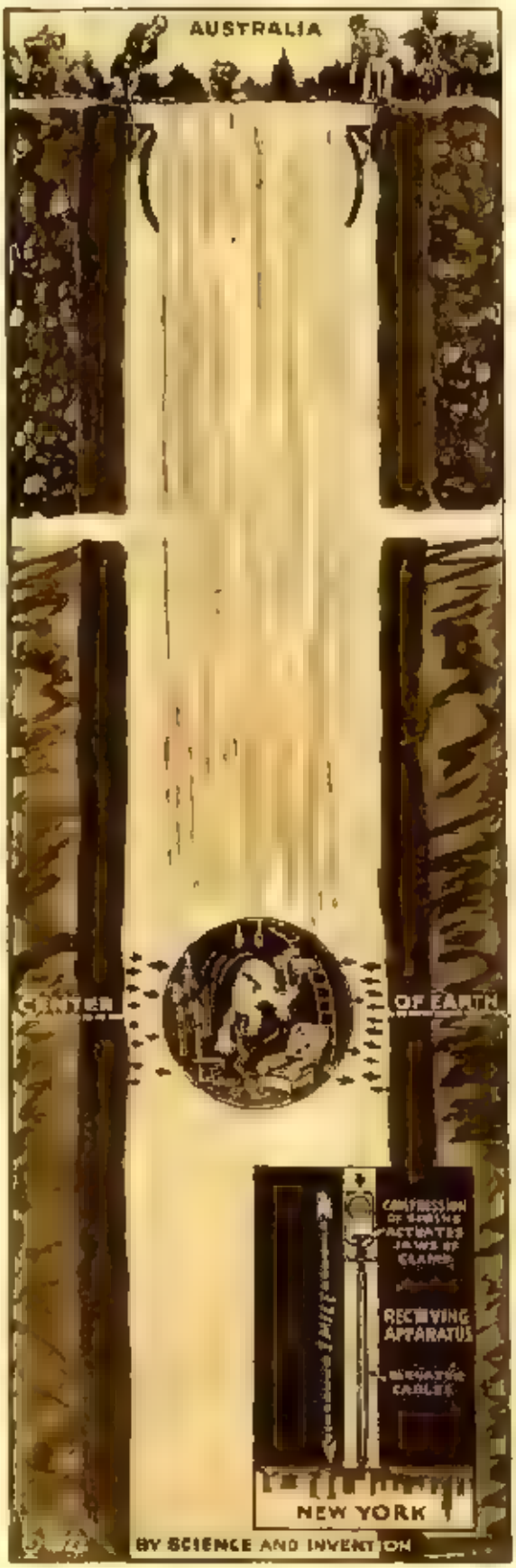
Some thirty years ago I made a careful study of the entire subject and incorporated my results in a story for boys entitled, "Through the Earth," which first appeared as a serial in *"Saint Nicholas,"* and was afterwards republished in book form by "The Century Company."

The book has long been out of print, however and the problems involved in the subject are so numerous and so interesting that I think it worth while to recapitulate here the solutions of the various questions.

The first problem, of course, comes in the digging of the tunnel. To bore a hole eight thousand miles deep, even though but 30 feet in diameter, is no easy matter. Yet the total amount of material to be excavated is not very great. If digging proceeded at the same time from both sides of the earth—say from New York and from Australia the total amount of material to be removed would be only one-tenth of a cubic mile in each of the two tunnels, that is to say, one-fifth of a cubic mile in all. It would be a smart engineer, however, who could succeed in making both holes meet properly in the centre of the earth.

In my story the excavation was effected by means of a specially constructed auger or boring-tool that descended as the work progressed, and whose cutting edges were continually replaced automatically by new ones. The tool was worked by electric power obtained from the waves of the ocean.

The tunnel was lined with a tube of a new substance which I called "carbonite" and which possessed the strength and lightness requisite for the purpose.




The Car Was Started Thru the Tunnel Which Passed from One Side of the Earth to the Other, When the Subject of the Experiment Climbed to the Ceiling of the Car and Then Let Himself Drop Head Down, Toward the Bottom. To His Surprise, the Subject Never Reached the Floor, the Act of Dropping Having Started the Car on Its Journey, His Body and the Car Then Dropping at the Same Speed. The Calculated Time Required for the Entire Fall Thru the Earth from Australia to the Receiver on the New York Side Was 42 Minutes, 13.4 Seconds. The Car Is Hauled Up the Last Mile in New York by a Clutch and Cable System, as Shown in the Drawing.

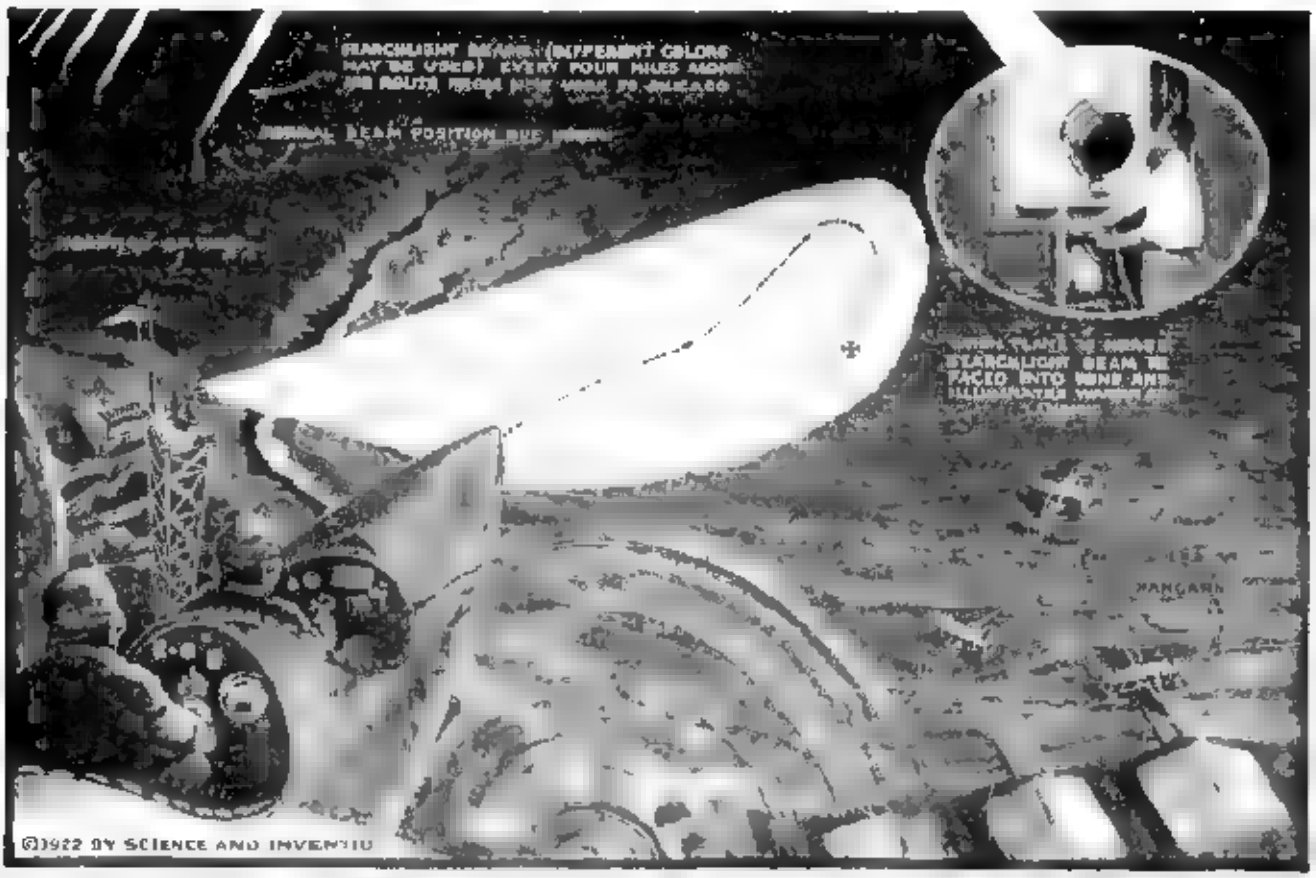
This tube was always kept in a state of fusion at the top, and was allowed to descend slowly into the tunnel as the boring progressed, new molten matter being added at the top.

As the work advanced, and the internal heat of the earth began to make trouble, special devices were attached to the tube, which converted the heat into electricity, this electricity being conducted thru the tubes to Australia and New York where the current was sold for heating, lighting, and transportation purposes, the sums realized netting a fortune after paying for all the expenses of building the tunnel.

Finally all obstacles are overcome and the tunnel is built. Then comes the problem of exhausting the tunnel of air. A column of air four thousand miles high would obviously render the experiment impossible, as the air at the centre would be under a tremendous pressure. So Doctor Joshua Giles—the originator of the tunnel—pumps out all the air possible, and then gets rid of the remainder by means of chemicals that have an affinity for the oxygen and nitrogen.

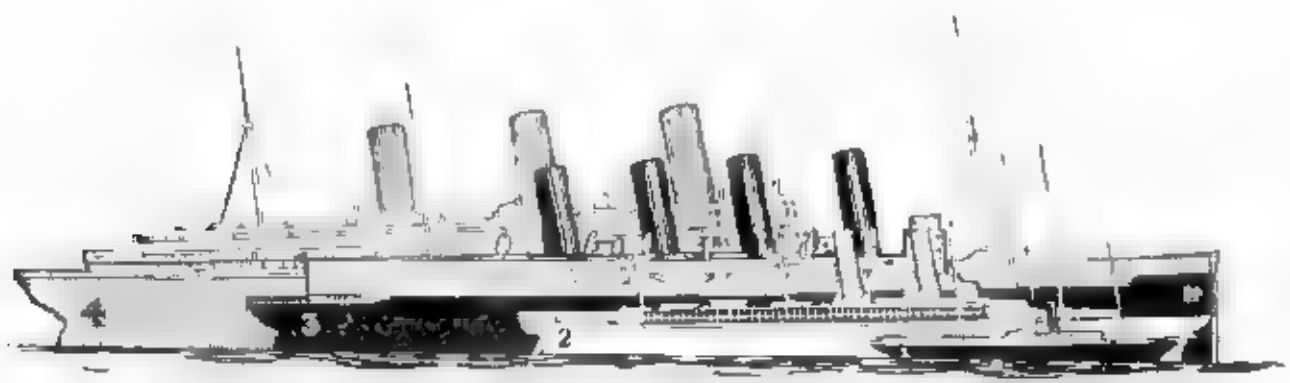
(Continued on page 272)

# First Aerial Lighthouse

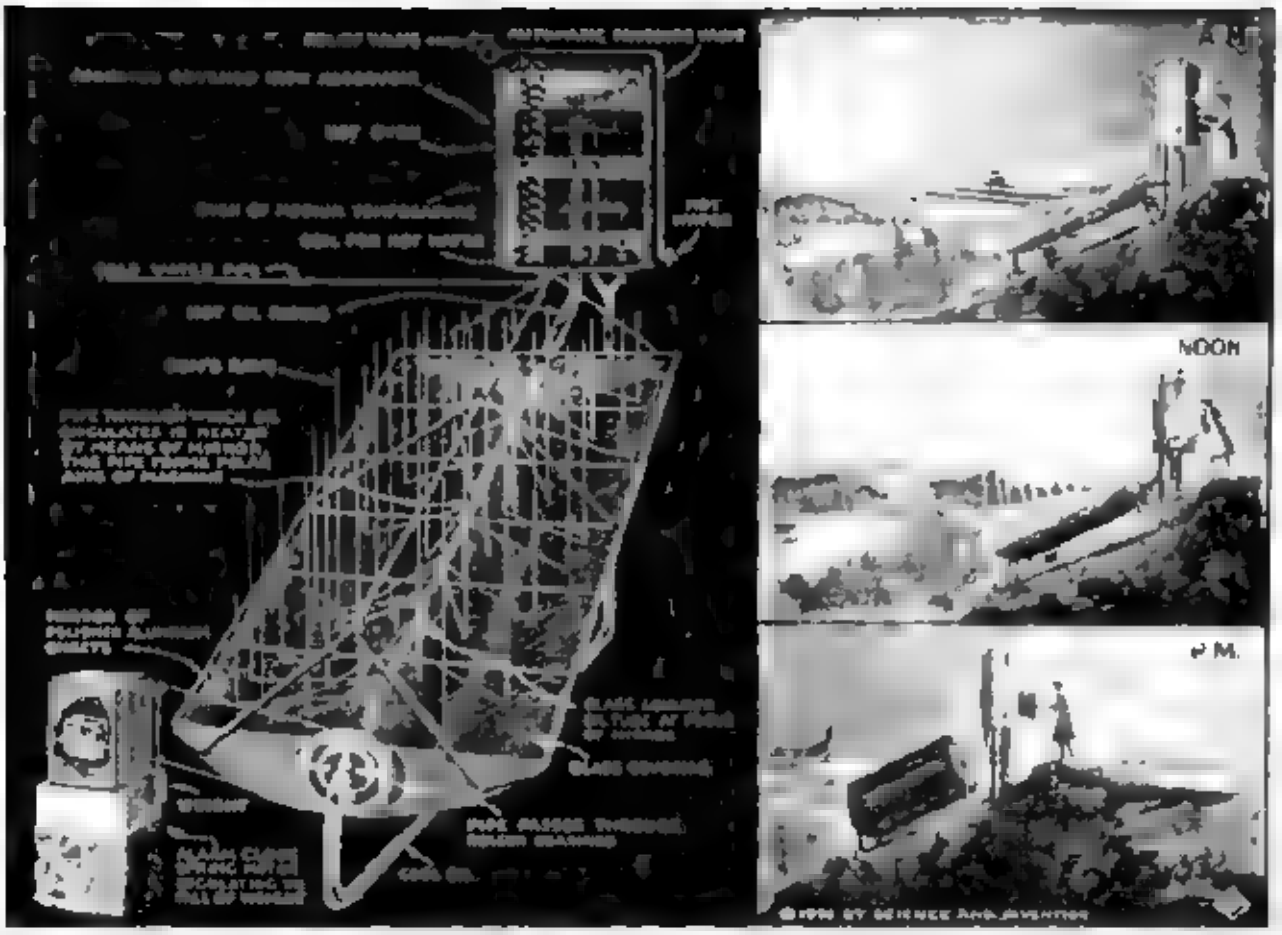



At College Point, L. I., Near New York City, the First Aerial Lighthouse in America was Recently Put into Service. The Searchlight Beam is Pointed Upward at an Angle of About 60 Degrees, but upon Nearing a Beacon Approach the Operator Swings the Light Beam in the Wind Indicating the Wind Direction to the Aviator, and Illuminating the Water to Facilitate Landing

# S.S. Majestic—World's Greatest Ship




The Above Comparison Illustration Shows the S.S. "Majestic" 956 Feet Long, Compared with the "Mauretania," 790 Feet Long; the U.S. New York (1888), First Twin Screw Steamship, 527 Feet Long, and the "Great Western" 1838, First Steamship to Cross the Atlantic and Having a Length of 236 Feet. The "Majestic" is the Largest Ocean Steamship Yet Built, and Recently Completed Her Maiden Trip Between Southampton and New York. If the Woolworth Building, We're Land on its Side in this Comparison Picture, it Would Only Stretch to the Length of the "Mauretania" and the Width Would Cover Some Two of the Tremendous Size of the "Majestic" While it is Nearly One-fourth of a Mile Long. See page 282




By Means of This Scarf Contrivance, Mr. C. G. Abbot, Assistant Secretary of the Smithsonian Institution, Washington, D. C., Made It Possible for His Wife to Cook Practically Everything Which Comes On a Gas or Wood Fuel Stove. The Accompanying Article Covers Considerable Detail. The Reflecting Surface Being Preferably Formed of Polished Aluminum Sheets. The Three Small Views at the Right Show How the Mirror was Turned Automatically by Clockwork, So as to Always Face the Sun. The Glass Covered Tube Passing Along the Focus of the Mirror, as Well as the Circulating Pipe and Oven Ducts, Were Filled With Oil

# Cooking By Solar Heat

M

Detail of Vacuum-Thermo Treatment Chamber Is Shown in the Drawing at Left

The Degree of Electrical Heat Produced From the Wire Molded in the Glass Vacuum Chamber Can be Regulated to Suit Each Case

# Heat and Vacuum To Cure Ills

IT has been well known to medical science that artificial heat when applied to any part of the human body increases the blood circulation in the part subjected to the heat in question and that this increased circulation of the blood enables it gradually to absorb and carry off various forms of congestion.

It has also been long known that placing any part of the human body in a closed vacuum appliance and gradually exhausting the air therefrom would quickly increase the circulation of the blood in the part or organ so encased.

An apparatus of the type shown in the illustration for the vacuo-thermo treatment of body ailments has been invented and patented by one Jean F. Webb, Sr., New York City.

The body of the enclosing chamber in which the leg or other part of the body is enclosed may be made of rubber, metal or as in the inventor suggests it which constitutions wire coils of nickel-alloy or other resistance wire material, of suitable size to carry the electric current needed, are imbedded or molded in the walls, to act as resistance coils for generating the desired heat. In the illustration herewith, the appliance shown is made of a heat resisting glass in which the electric heating wires are imbedded and the glass is annealed in the same manner as a fire glass is made. The transparent glass causes the effect of the vacuum or heat treatment to be visible to the patient in self-treatment, the said treatment can be regulated as desired and in the manner hereinafter explained.

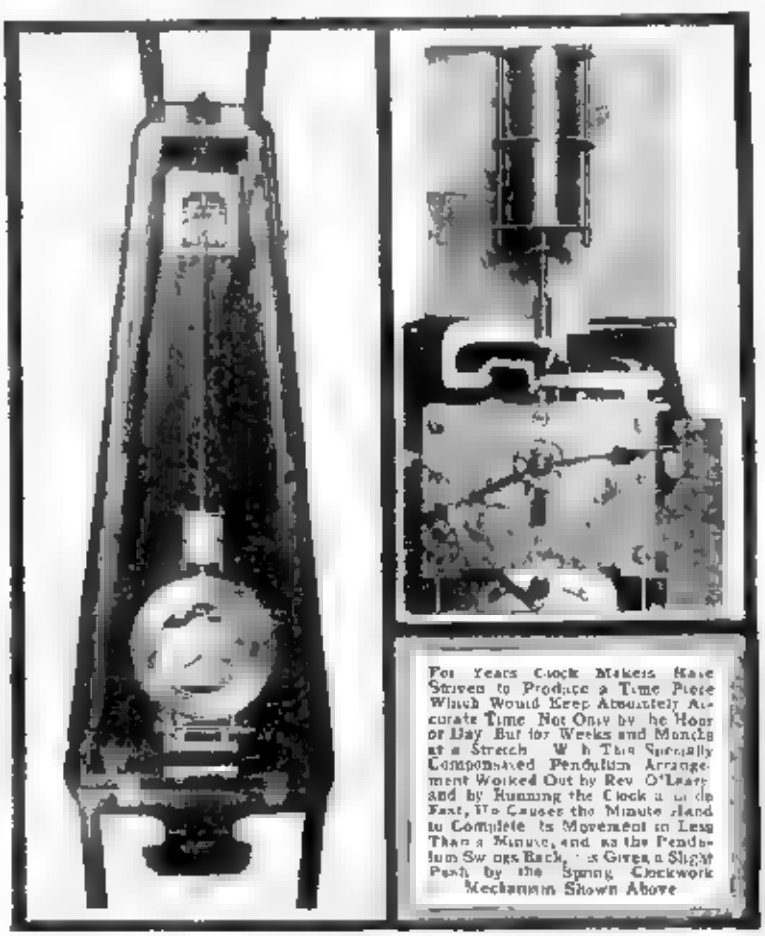
# A "Free Pendulum" Clock

REVEREND WILLIAM O'LEARY a native of Ireland and Professor of Science in Dublin, has perfected a clock, utilizing the principle of a free pendulum, which keeps absolutely accurate time. His reason for perfecting his clock was for observatory work and experience in observing the use of a seismograph. The observer has many occasions, pondered he wished to have a clock that would keep absolutely correct time. He tried all of the various makes of high grade time pieces and found that each one of them had a certain amount of variation. He therefore decided that he would make a clock himself. The method which he decided to adopt was that of the absolutely free pendulum.

So-called free pendulum clocks have been put on the market at various times before but have not actually lived up to their name. Many of these types depended upon the pendulum closing an electric circuit. This, however does not constitute a perfect escapement.

The clock makers' ways of making highly accurate gears and works was dispensed with, and his first model was made from the works of an alarm clock, using the principle of the free pendulum. It was possible to have works that would vary as much as three-quarters of an hour in the course of a day and still keep absolutely accurate time. This may seem like a very ambiguous statement but is nevertheless true owing to the fact that

(Continued on page 279)



For Years Clock Makers Have Striven to Produce a Time Piece Which Would Keep Absolutely Accurate Time Not Only by the Hour or Day But for Weeks and Months at a Stretch. With This Specially Compensated Pendulum Arrangement Worked Out by Rev. O'Leary and by Running the Clock a Little Fast, It Causes the Minute Hand to Complete Its Movement in Less Than a Minute, and as the Pendulum Swings Back, It Is Given a Slight Push by the Spring Clockwork Mechanism Shown Above

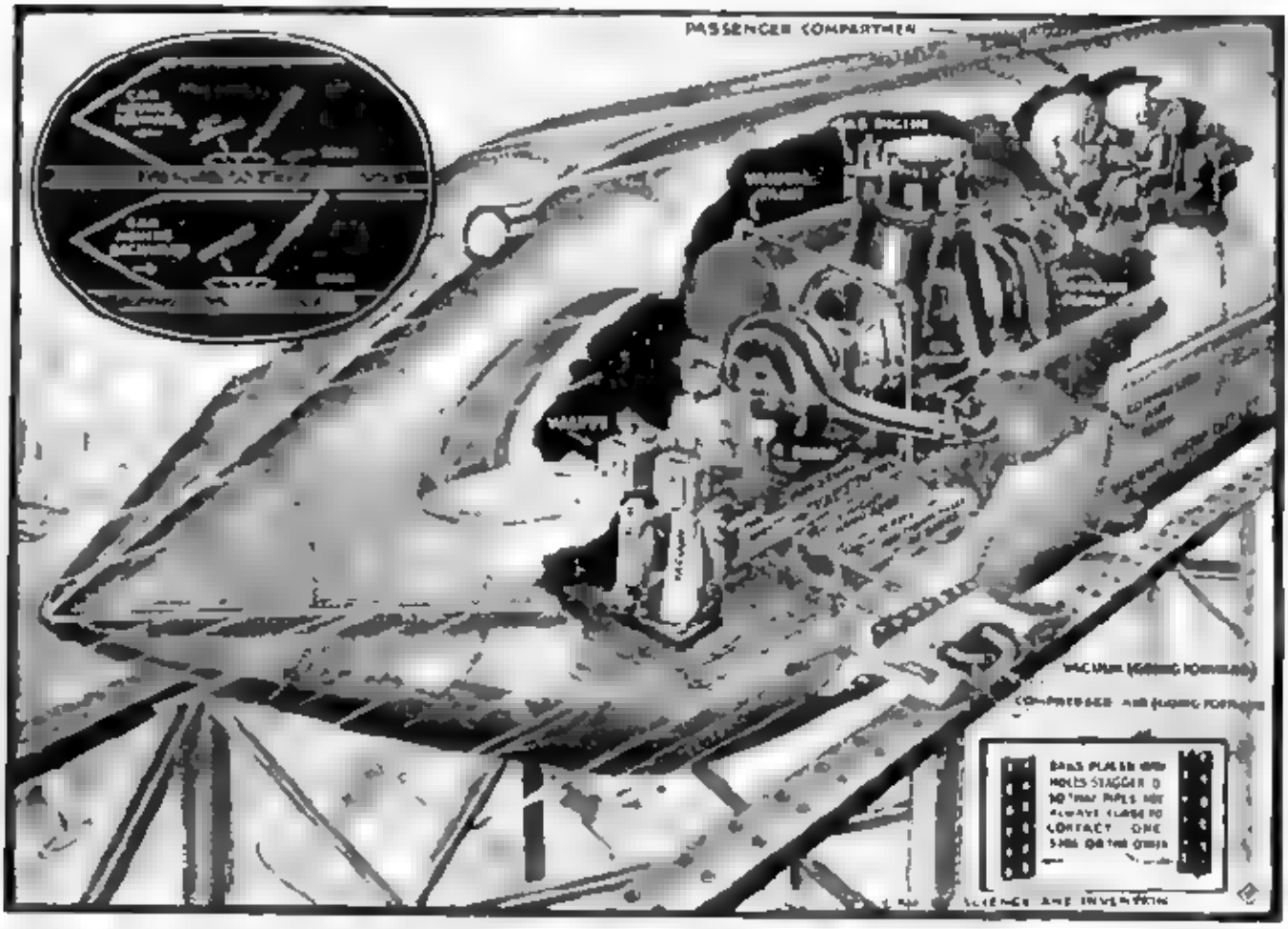
August

$350.00
IN PRIZES
IN THIS
ISSUE

# Science and Invention

## THE TRUTH ABOUT PERPETUAL MOTION

*See Page 338*




This Latest Idea in Railway Propulsion Systems Operates on the Principle of Compressed Air Jets Which, Emerging from Slots on the Sides of the Car Against Openings in the Tracks, Tend to Push the Car Forward. The Locomotive Also Consists of Projections of the Air Is Sucked Away by the Vacuum Pipes Leading Down Thru the Slots, and These Vacuum Pipes Also Cause Any Oil or Water Lying in the Track Pockets to Be Removed Therefrom. Power for Driving the Air Compressor to Charge the Tanks on Board the Train Is Provided by a Gas Engine or Electric Motor. To Reverse the Motion of the Car or Train, Compressed Air Is Passed Thru the Pipes Pushing Forward While the Vacuum Is Caused to Act Thru the Rearward Facing Pipes, as the Dotted Lines Show Clearly

# Compressed Air and Vacuum Railway

RAILWAY engineers have frequently expressed the opinion that it really is remarkable how tied down we are to the use of rolling wheels for cars of every description, no matter whether they are steam, electric or gasoline engine [illegible] to take on a coat of ice the same as the refrigerating machine pipes we frequently see in ice plants. A second scheme described in the same article was employing smooth cylindrical tracks, over which the cars were to run on grooved runners or shoes, a sufficient quantity of oil being kept on the rails or else fed thru the car shoes. Now comes a third scheme for operating railway cars without wheels, and which operates with simple and well-tried apparatus, viz., compressed air and a vacuum, produced by machinery well-known to engineers today.

In a recent patent granted to Mr. Frank George Trask of North Dakota, he shows some clever ideas for a wheel-less railway train and the principal features of his invention are illustrated in the accompanying picture and drawings.

Briefly, his scheme for propelling the wheel-less car or cars along the rails, is to shoot compressed air at high pressure out of a series of shoes in a backward direction down into a series of angular pockets in the rails, the reaction from this compressed air causing the car or train to move forward. The compressed air is stored in the locomotive of the train, by means of an air compressor driven by a gasoline engine. The air compressor [illegible] driven by an electric motor [illegible].

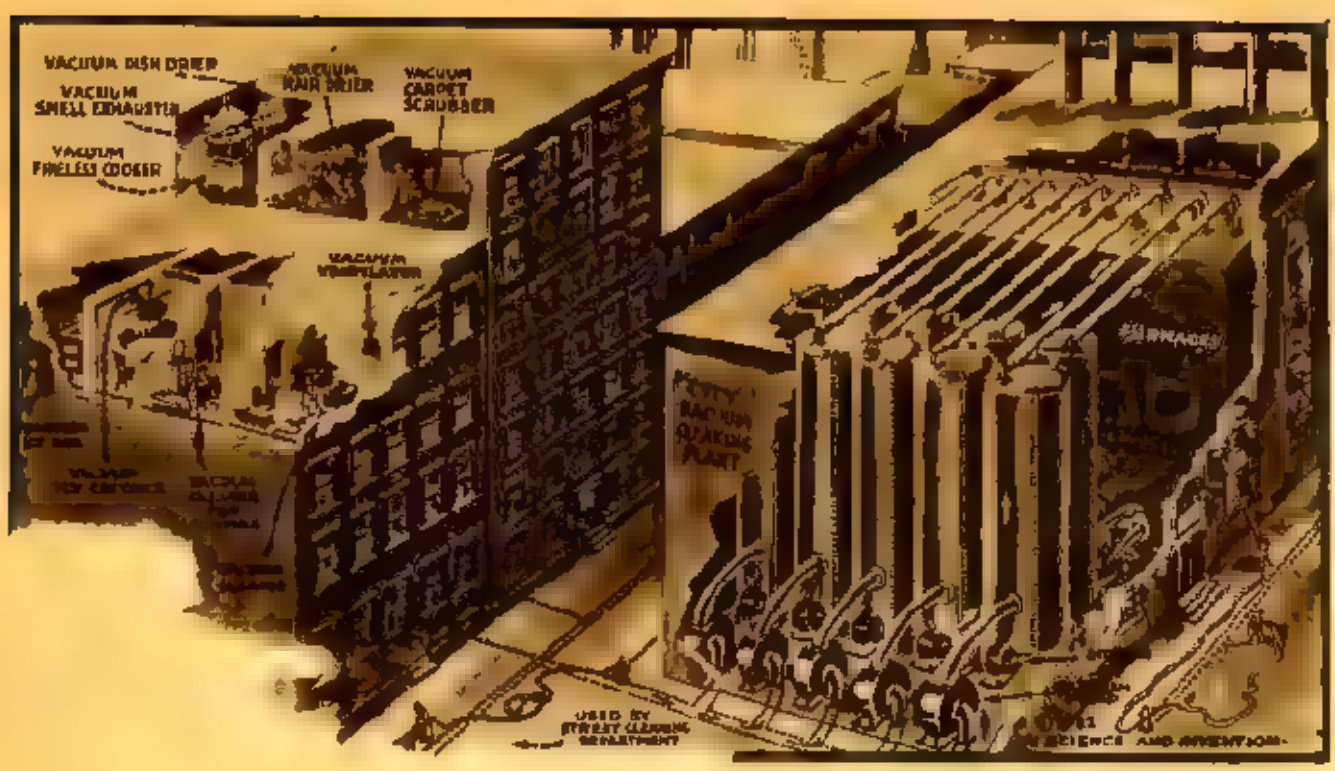
The same motor or engine drives a vacuum pump, which maintains a certain degree of exhaustion in the vacuum tank, both the tank and that containing the compressed air under high pressure, are piped to control valves arranged in the manner illustrated.

When the motorman or engineer throws the valve levers so as to direct compressed air [illegible] pipes in the shoes, so as to shoot the stream of air rearward, the car moves forward; at the same time the levers open the valves, so as to connect the [illegible] with the opposite holes in the shoes pointing rearward, and this serves to remove oil or water from the track recesses.

Possibly many of us have seen the compressed air locomotives used extensively in mining work, and these have a range of several hundred miles on one charge of compressed air, the locomotive containing a series of large steel tanks in which the air is stored at high pressure. This provides another way of [illegible] way, sufficient air being stored in tanks on the locomotive for an average run, and, as he points out in his patent, it is possible for the compressed air tanks on the engine to be replenished from a supply station or tank along the route. Of course, the train would have to come to a stop in order to recharge the tank. It hardly being feasible to replenish the air supply while the car is in motion, as water is picked up from long troughs on the large steam railway systems today.

[illegible] it only being necessary to [illegible] levers and direct the compressed air into the [illegible]-pointing holes in the rail shoes, and [illegible] the vacuum tank lines to the rearward-pointing holes in the shoes. When this is done, the train will move backward [illegible] very rapidly [illegible] power compressed air will exert under a considerable [illegible] will be obtained by using, after having secured [illegible] obtained with 150 and 180 lbs. per square inch pressures.

Riveting hammers and stone-cutting drills [illegible] being done daily by compressed air at [illegible] [illegible] aided and abetted to some extent by the vacuum or air exhaustion thru the shoe ports.




It Has Been Proposed by a New York City Genius That Either a Centralized Vacuum System for Cleaning the Streets be Tried, or Else Large Vacuum Cleaners Mounted on Motor Trucks for the Purpose. One of the Principal Reasons for Utilizing Vacuum Cleaning for Streets is, of Course, to Eliminate the Dust and Consequent Pollution of the Air With Myriads of Disease Germs for People to Inhale. With a Centralized Vacuum Cleaning Service, Such as That Proposed, Many Other Adaptations of Vacuum Systems for Housekeeping Suggest Themselves. Thus We May Have in the Near Future Vacuum Ice Boxes, Fireless Cookers, Insect Exterminators, Hair Dryers, Ventilators to Take the Place of Fans, Dish Driers, Smell Exhausters, Et Cetera.

# Vacuum Cleaned Cities of Tomorrow

NEW YORK CITY will save hundreds of thousands of dollars, cut the mortality rate by the elimination of disease-bearing dust and free 2,000 *whitewings* for subway construction and other needed work if it will sweep its streets with vacuum cleaners, says an appeal transmitted by the *Potential Future League* to Street Commissioner Taylor recently.

Mr. W. A. Cochrane is father of the idea. He believes that a suitable motor-driven vacuum cleaner can be built at reasonable cost and that it can be operated economically. He says that the present system is as obsolete as the horse-car.

No doubt the cities of tomorrow will be cleaned by a piped vacuum system, the same as our homes are cleaned today, unless some better method is invented, of which we are not as yet aware.

Large central vacuum cleaning plants, operated by private concerns or preferably by the cities themselves, will be connected with pipes running through the streets the same as the present water, steam and gas pipes. The vacuum cleaner terminals along the street will resemble our present fire hydrants, and in one scheme it is suggested that street cleaners will draw the dirt and dust from the pavements and streets by means of long hoses, on the ends of which will be fitted suitable metal mouths, similar but larger than those now used in the home vacuum cleaner. A second scheme which has been suggested does away with all personnel, the suction action being automatic and continuous or semi-continuous.

In any event, the dust and rubbish sucked through the pipes to the central vacuum cleaning plant can be incinerated in suitable furnaces or other uses made of it which the engineer of tomorrow may provide for. Possibly this dust and rubbish can be suitably treated or manipulated so as to be compressed into briquettes for burning, constructing buildings, or some other application.

And when we have with us these large centralized vacuum stations there are a number of other uses which will appeal to householders, several of which are illustrated in the accompanying picture. Houses will then be connected to the central vacuum system, and besides utilizing this great convenience for the purpose of cleaning the carpets in our apartment, we will no doubt have vacuum ice-boxes, vacuum fireless cookers, vacuum fly exterminators attached to chandeliers, etc., to draw all flies and other insects out of the air in the room, not to mention vacuum dish driers for the kitchen, vacuum hair driers for milady's boudoirs, smell exhausters to place over the kitchen ranges and air circulating registers, causing a draft or movement of the air in a room similar to that effected by the electric fan.

It is not any more difficult to pipe vacuum service than it is to pipe compressed air, and with the present highly efficient method of electric and acetylene welding of pipes it has become quite easy to make perfectly air-tight continuous conduits for long distances. We have mentioned here but a few of the many things that can be done when we buy vacuum service at so much per thousand cubic feet.

Coming once more to the cleaning of city streets by vacuum, which will mark a great step in advance indeed in this direction, we believe it will prove more economical, all things considered, to employ large portable vacuum cleaners, modeled somewhat like those we use in our homes, and propelled by gasoline engines, in other words, we could mount the large exhaust blowers, tanks, dust catchers, etc., on a motor truck chassis—at least this scheme would well merit its being tried out.

# Aerial Battle Against Insects

Details of the first aerial battle in the war between insects and man were learned when J. S. Houser and C. R. Neillie, eyewitnesses, described a recent encounter between one airplane laden with poisonous dust and thousands of caterpillars firmly infesting the tops of a large grove of catalpa trees.

Casualties are estimated at 99 per cent. of the [illegible] foe. The human forces suffered no harm whatever. The battle lasted only fifty-four seconds. In this time one airplane accurately dusted a six acre grove, containing 4,815 trees, 25 to 30 feet tall, whose leaves were being devoured by the caterpillars. The engagement took place at Troy, Ohio, and the campaign against the caterpillars was directed jointly by the U. S. Air Service, the Ohio Experiment Station and the Department of Forestry of Cleveland.

Airplanes have been used previously by the insect-fighters for scouting against the pink boll weevil in Texas and forest insects in Canada and the United States, but this battle is believed to have opened a new era of offensive anti-insect warfare from the air.

# Unlimited Destruction

## By ERNEST K. CHAPIN

PRESIDENT SEABURY leaned back in his chair and frowned as he pushed a pile of papers that lay on his desk before him. "'There is something rotten in the state of Denmark,'" he quoted under his breath, "but I'm afraid rottenness is not confined exclusively to that state. The whole world fairly reeks with it, and unless something can be done to prevent trouble we are in for a dose of it that will put civilization on the rocks." His soliloquy was interrupted by the hurried entrance of the Hon. James Bushworth, his secretary of state.

"Any news?" he asked as Bushworth entered.

"Alas, yes," he groaned in reply. "The Palmola islanders have revolted, seized the Japanese garrison, tortured and murdered the handful of soldiers within it, and put themselves in complete possession of their native isles. Unquestionably Japan is furious and will take vigorous steps to avenge the atrocities perpetrated upon her soldiery and to recover her possessions."

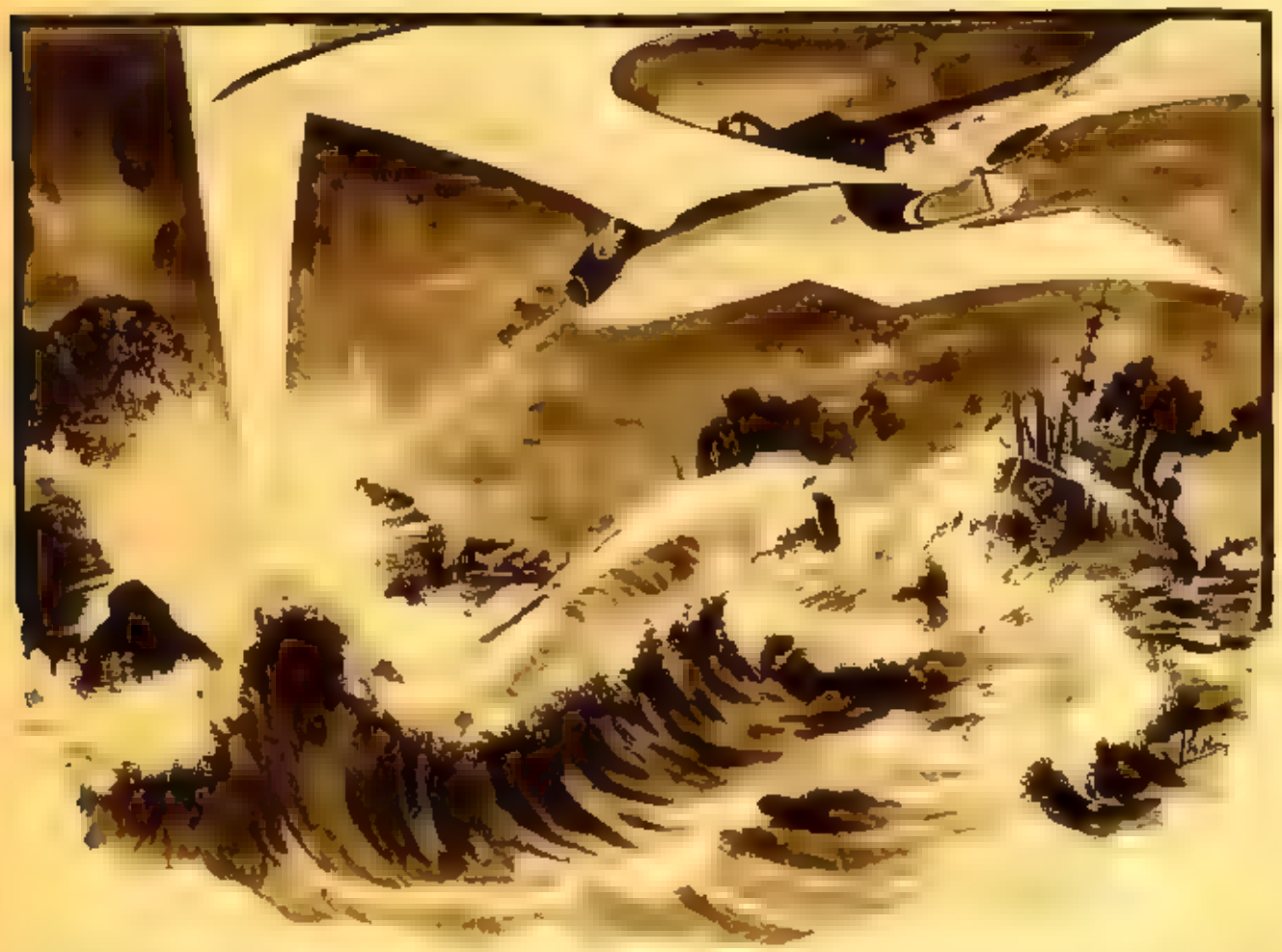
"Beyond a shadow of a doubt," agreed the president gravely, "and in the meantime what is the rest of the world going to do about it? One powerful group of nations have contested Japan's right to these islands, while an equally powerful group have not only recognized her claim but have promised support if it is needed. Practically every nation on earth has some vital interest affected by this controversy, already one of long standing, and now that the unfortunate islanders have taken matters into their own hands the chance of amicable settlement seems indeed remote. If it were not for the strategic importance of these islands, their value as a naval base and their vast mineral wealth, the matter might successfully be arbitrated, but considering the problem in the light of present world conditions it is obviously impossible to do all that. With the ten-year naval holiday at an end, with commercial rivalry at its height, with all corners of the earth closed to colonization, with race hatred, fear and jealousy more intense than ever before and with the wounds of the last great war unhealed, to say nothing of the fresh wrongs daily committed, Bushworth it would seem that the world is again on the brink of a great war. And just as the murder of a single man in 1914 set the nations at each other's throats, so now in 1934 I believe this miserable skirmish in the Palmolas will set them off once more."

"And what a war it will be," exclaimed Bushworth. "A fight to a finish with machinery a thousand times more destructive, with gas a hundred times more deadly than any that has been used before, and with all the forces of nature invoked to hasten the destruction of man, Mr. President, another war will mean the end of modern civilization. No nation can drag its people through such a war and survive. The forces of reaction and Bolshevism, already a menace in all parts of the world, will sweep away modern forms of government and plunge the earth into the same state of chaos that Russia now finds herself."

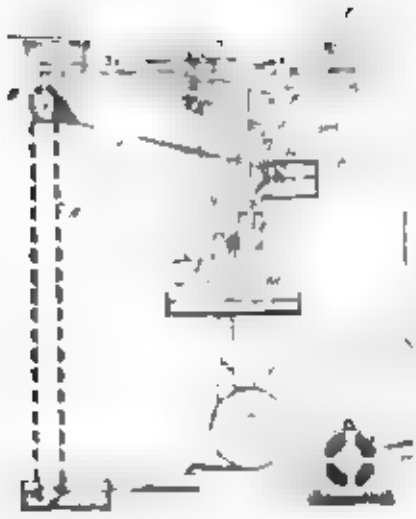
"We must waste no time in words," returned the president. "The bubble of danger that has been expanding for some time, has at last burst and we must act quickly if we are to avert or postpone the calamity." And so saying the president and his secretary laid aside every other task and bent their energies to the one of preventing a world war.

By the end of the day the president had communicated with every nation of consequence and had done everything possible to delay if not prevent, the disaster which seemed inevitable. At last, wearied by his exertions, he dismissed his stenographer and rang for his private secretary. "Digby"

(Continued on page 382)



"From the Solitary Gun's Eye a Blue-Green Pencil of Light Shot Forth, Quivered for an Instant on the Surface of the Boulder and at Once Disappeared. Almost Instantly from the Rock Flashed Skyward a Blinding Light Accompanied by a Report Louder by Far Than Any Explosion. The Crew, at First Stunned by the Shock, Were the Next Moment Deluged by a Huge Wave That Completely Swept Over the Vessel, Washing Many of the Men Into the Sea."



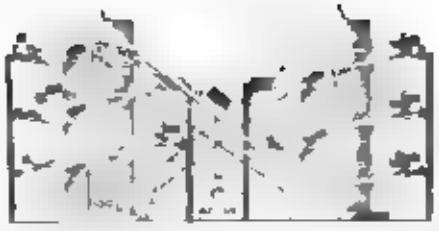


Fig. 1—This Endless Track is Another Inventor's Dream to Secure Something for Nothing. The Four or Five Cars Coursing Downward on the Long Sloping Track Theoretically Raise the Car on the Short Incline. The "Excess Power" is Used to Drive an Electric Generator and Light Lamps, etc.

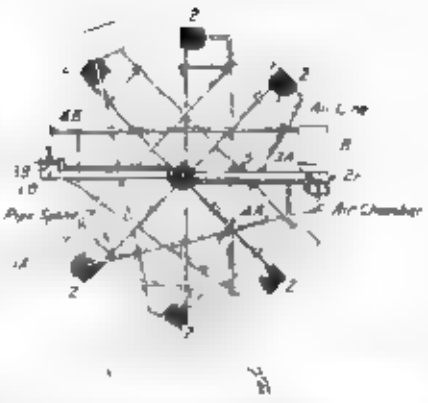


Fig. 2—The Machine Shown on Our Cover. Studying This Above Sketch Will Help You Understand How the Device Works. But We Do Not Believe You Can Make It Do the Work. The Explanation of the Diagram is Given in the Text.

A Letter From Reader Describing This Machine and Three Others. Explanations Why Machines Will Not Produce Power or Even Move. This Machine in Operation. Apparatus to Produce Liquid Motion. The Buckets Shown at A Are Moved Upward by Levers "C" Operating Through Crank Shaft B.

# The Truth About Perpetual Motion

## By JOSEPH H. KRAUS

PERHAPS more minds have worked [illegible] money has been spent by inventors and engineers in trying to attain what is [illegible] many other researches of practical merit. Before discussing the various ideas on the subject of perpetual motion, let us first determine just what the words imply. There are two meanings connoted in the term perpetual motion. The literary meaning which refers to *unending motion* such as we see in the movements of the heavenly bodies, the tides, waves on the ocean, etc., and the conventional meaning which is used throughout in this article [illegible] that in raising a weight power is used. That same weight if it descends will generate power. The inventors of perpetual motion devices therefore reason that a machine could be built which would generate sufficient power to raise the weight, then again use that self same power in order to energize sufficient at least to raise the weight once more. No outside source of power other than the force of gravity is permissible employed in these mechanisms unless, of course, the energy developed by the machine will generate sufficient power to again drive it, regardless of whether that power be electrical, explosive or what not.

The fallacy of many of the machines here described can be pointed out ignoring completely the friction of the bearings or moving parts. The first perpetual motion device is the one submitted to us by Mr. Jose Martinez. (See Fig. 1.)

### The First Prize Problem

In this device four chains of buckets are mounted all operated on the same crank shaft. The operation of the device is supposed to be as follows. The endless chain of buckets A, being filled with water on the ascending side are exactly counterbalanced on their crank shaft B by the adjustable sliding weights D, acting through the levers C on this crank shaft. Cam K is now permitted to turn, which allows water from the reserve tank H to flow out into buckets I. When one of these buckets is filled cam K still revolving closes the valve J and draws the trigger F forward by the action of the sprockets on the trigger release E. It is meant that the crank shaft, which was formerly exactly counterbalanced to such a degree that even an ounce of additional weight would cause it to revolve by causing the lever to become unbalanced, is now permitted to move, due to the added weight on one side of it. When the bucket descends to its lowest point, it tips over the water pouring into the trough M and descending through the pipe 150 feet long, produces sufficient water head or pressure to turn the water turbine. This turbine in turn not only drives the trigger release E and the cam [illegible] to the inventor.

## $150.00 in Prizes

THE three perpetual motion machines illustrated in Figs. 1, 2 and 3 each carry with them a prize of $50.00 in gold for the best explanation of why they will not work. In the words for the best explanation of why [illegible] will not perform as described on the accompanying [illegible] a prize of $50.00 will be awarded. For the best explanation of why Fig. 3 will not operate a prize of $50.00 will also be awarded. The [illegible] prize of this series which closes September 5th, 1921, is $150.00. No [illegible] to the contest. In the event of a tie [illegible] one contestant [illegible] an equally worthy [illegible] a duplicate prize will be awarded [illegible]. The decision of the judges is final. [illegible] minor explanations as they desire, which should [illegible] to the sake of the argument. [illegible] Machines [illegible] each explanation, and a contestant may [illegible] all of the prizes.

[illegible] explanation as to why this great conception will not work is left to the reader. It should be simple and the factor of friction is to be ignored. It may be mentioned that the relation of the weight to the power arm in the levers is changeable and two buckets of each chain full of water turn over the top of the crank shaft B for one complete revolution of the crank shaft.

For the best explanation of why [illegible] will not work, a prize of $50.00 will be paid.

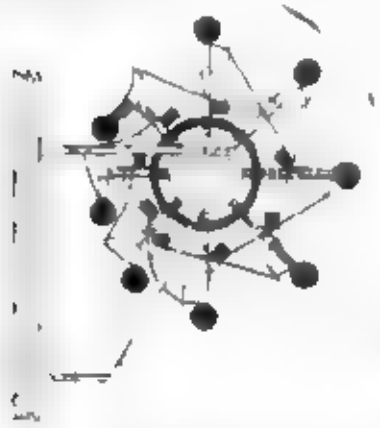
### Second Prize Problem. Machine Shown on Our Cover

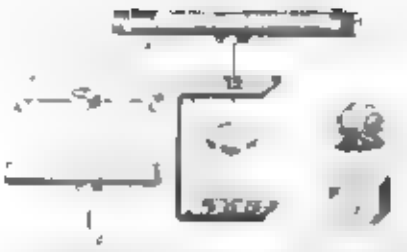
Fig. 2 is the machine shown on the cover of this magazine and illustrated again here with. 1 are weights. 2 are cylinders in which pistons. 3. operate through levers. 4. It will be seen from the diagram that in the position of the machine as shown the piston 3A in cylinder 2A is being forced upward by weight 1A acting through lever 4A compressing the mercury in these pistons [illegible] pressing it through the tube 5 to cylinder 2B. The piston 3B is being forced upwards creating a partial vacuum on that side of the machine caused by weight 1B descending and acting upon the piston 3B through levers 4B. This action, according to the inventors, Messrs. Larson and Ross, is to continue indefinitely. Why will it [illegible] not work? We offer $50.00 for the best explanation of its failure to operate.

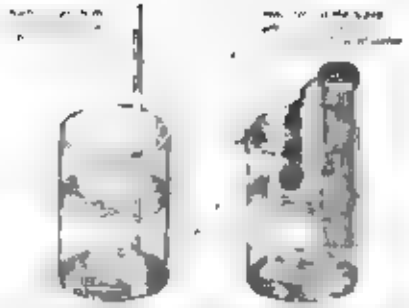
### Third Prize Problem—Machine "Actually Patented"

On April 20, 1920, Mr. Venzel Zeman of Schenectady, N. Y. actually secured a patent on a power transmission apparatus, which seemed very, very much like *perpetual motion*. We communicated with Mr. Zeman, and were informed that his system was indeed the only perpetual motion device worthy of consideration. In the patent, the number of which is 1,337,873, mention of a motor is made in the specifications, although in none of the four patent claims is such use of the motor claimed. This omission according to the attorneys, must be inserted, otherwise the patent would be purely a perpetual motion system and as much as the U. S. Patent Office will accept patents on perpetual motion schemes unless a working model is submitted it is quite necessary to enter arguing means for the device. According to Mr. Zeman however the power transmission apparatus is perpetual motion. He has not been able so far, to produce a model that works, and never will be able to do so.

The device is supposed to operate as follows. A long spiral descending track is arranged about two vertical columns, these columns are rotatable. It is evident that the descending spirals are much longer than the ascending one and tracks. A link chain assists the cars upwardly along the inclined plane to the top of the spiral, where the car is released. Here it meshes with the revolving cylindrical drum, turning it around. According to the inventor there will be two or more cars constantly descending, while one ascends. Consequently, the drums as they revolve will lift the weight of the car which ascends easily because the combined weight of the five cars moving on the downward course on the spiral is greater than the weight of one car. This action is to take place indefinitely and power removed from the driving wheel. (See Fig. 3.) The third prize of $50.00 will be paid for the best explanation of the fallacy of this scheme.







## Some New Perpetual Motion Systems

[illegible] perpetual motion systems or attempts at perpetual motion. Sometimes it is very difficult to explain these attempts, sometimes rather simple. From Walter J. Williams, comes a photograph of a perpetual [illegible]

[illegible] Criminal Mr. W. Thomas asks how his device operates. Two magnets are arranged near the base of a plate, as shown in the accompanying photograph. [illegible]

[illegible] generated [illegible] motion has set up a deposit at [illegible] re the wires are attached [illegible] [illegible] wires for the arms with [illegible]

[illegible] device [illegible] that the installation is a failure [illegible] you have very possibly a greenish colored solution. [illegible] ing of copper will never generate [illegible] [illegible] ity no effect on the magnets. In the third place the attrac- [illegible] the same on both sides of the pendulum [illegible] there be any shield for magnetic [illegible] [illegible] depended on the magnetic properties of [illegible]

This magnetic device brings forth a construction of a magnetic motor of unusual [illegible] Fig. 5. This device was invented in the early part of the 9th century. Two [illegible] [illegible] weights brought up to [illegible] [illegible] [illegible]

September

# Science and Invention

25 cents

## THE SLOT MACHINE RADIO

See Page 442

# The Slot-Machine Radio

By H. GERNSBACK
(MEMBER AMERICAN PHYSICAL SOCIETY)

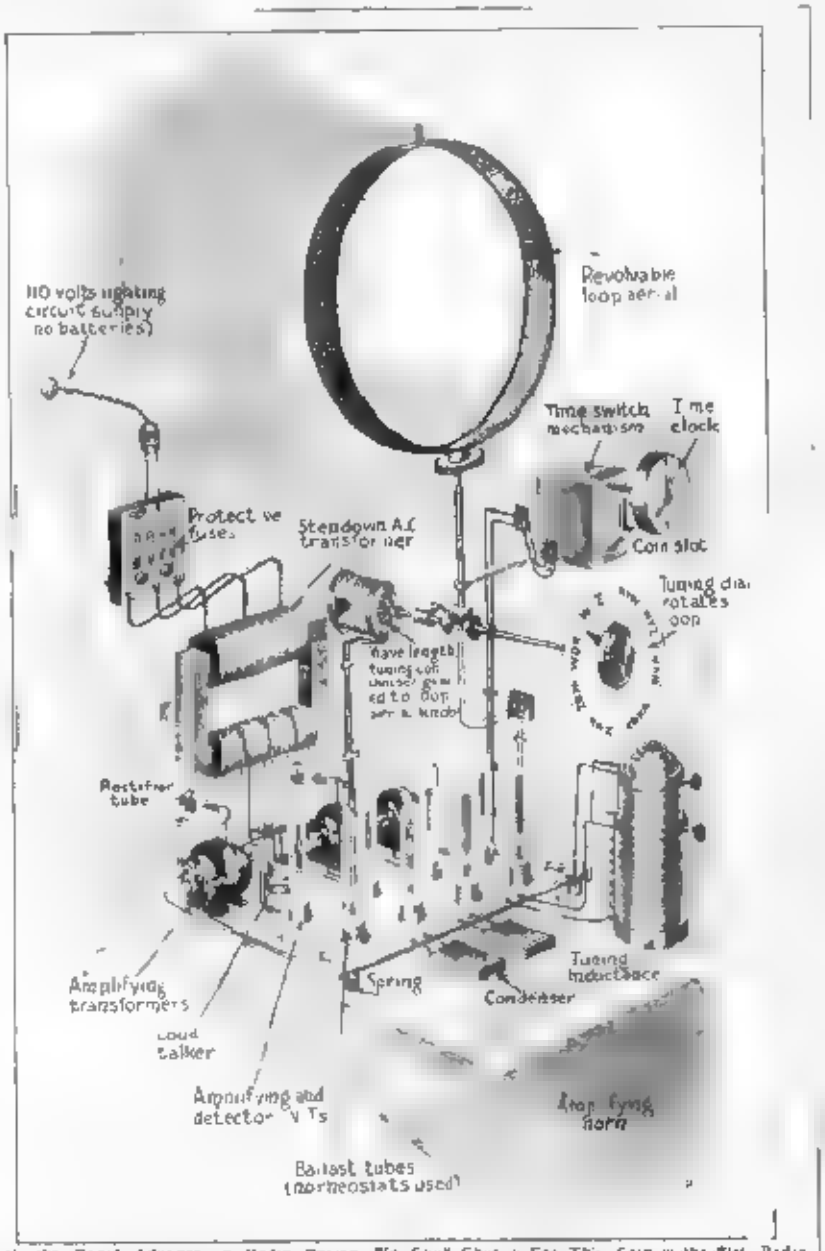
THE radio science is moving so rapidly these days that it is difficult to keep abreast of all its achievements. Moreover, we have become hardened to all the new wonders that are brought about by radio and we merely shrug our shoulders today when another development comes along. The latest addition to the radio family is a slot machine radio, which is now being developed by an eastern manufacturer. There was no reason, of course, that a radio slot machine could not have been built and manufactured for actual use five or more years ago. There was no demand for such a machine and none was produced. Today everyone is interested in radio, and with entertainments, from grand opera down to reports of prize fighting being broadcasted all over the country, such a machine is needed and demanded by the public.

There are, of course, various ways of constructing such a machine, and one example of its construction is shown in our illustration.

If a machine of this kind is to be used in any great quantity, for instance one in every suite of a 2,000-room hotel, the problem becomes complicated. In the first place, it is not possible to have an outdoor aerial for each outfit. Imagine the roof of one of our large hotels equipped with 2,000 aerials! Mainly such an idea, on its face, is preposterous. It therefore follows that we must use the loop system.

On the other hand, every radio receiving set is also a radio sending outfit, as is well known, and unless the correct steps are taken every hop will send out a wave of its own, interfering with other outfits. By a correct filtering system, however, it can be done away with in such a way that there will be little interference between the various receiving outfits. Also the smaller the loop used, the less will be the interference between the different outfits. The small loop, as shown in our illustration, as well as on our front cover, would perhaps be ideal for work of this kind.

One of the most important points to remember in an appliance of this kind is that it must be thoroughly practical. There must not be more than one knob or handle, and the adjustments must be all fixed in such a manner that the user will not have to change them once the set has started operating. Our illustration shows how this can be accomplished. In the first place, we have no batteries, either "A" or "B". The circuit is taken off a 110-volt lighting circuit, which may be either A.C. or D.C. If it is A.C. we need a transformer as shown. We also need the rectifier tubes shown, which in a sense represent the "B" batteries. This system has actually been tested out by the Bureau of Standards, and it works. As for the arrangement of the circuits, we need not go very deep into this, for the reason that there are a number of hook-ups, and with a set of this kind we need at least six vacuum tubes, on account of the small loop used.




With the Rapid Advance in Radio Design We Shall Shortly See This Coin-in-the-Slot Radio Receiver Installed in Hotels, Railroad Stations, and Other Public Places. All One Has to Do to Enjoy Any Variety of Music or Speeches Desired is to Drop a Coin in the Slot and Then Turn the Knob Until the Call Letters of the Station Which is to be Listened to Corresponds With the Index Pointer Shown, Which Turns the Concealed Loop Aerial Toward the Selected Station. The Apparatus is Entirely Automatic and Operates From the 110-volt Lighting Circuit Without any Batteries, as Described in the Radio Department of this Issue. Four of the Vacuum Tubes Shown are Ballast Tubes Which Automatically Regulate the Filament Current to the Four Detector and Amplifying Audions in Place of the Usual Hand-Operated Rheostats. The Audions are Lighted When the Coin is Deposited in the Slot. The Apparatus is Self-Contained and Easily Made Fool-Proof With the Present Knowledge of the Art.

The usual amplifying transformers and condensers (variable as well as fixed), can be seen in the illustration. A loud-speaking telephone receiver, as, for instance, the Baldwin type C, or any other similar means, can be used to connect with the lower horn from which the music or entertainment issues.

The tuning inductance shown is, of course, set and fixed when the instrument is first installed. There are however a number of taps left in order to make changes when new stations come into use, or if the wave lengths are changed. The Company's Maintenance Department would have to take charge of these things.

We now come to an interesting means proposed by the author and which shows how by a very simple method the loop can be turned by a center knob, and a certain amount of tuning done, all simultaneously. It is a well-known fact that if you receive from one station and then turn the loop to receive from another a certain amount of tuning must be done, else the entertainment will not come in at maximum strength. To overcome the [illegible] whistling sound may be set up, which can not be avoided unless some tuning is done. The writer proposes to connect to the loop, by means of gearing, a sort of vernier condenser which is placed in the circuit. This condenser is again geared as shown then by turning the front dial through quite a large angle the shaft of the condenser will turn only a very small amount. Of course the ratio of gearing has to be ascertained by experiments, as well as the positions of the stations plotted on the indicating dial. In practice, therefore, the dial would very likely [illegible] when the set leaves the factory the Maintenance Department when installing the outfit would then listen in for, let us say, WJZ. They would find a point where this station would come in loudest. They would then engrave the dial at this point with the call letters of that station, namely WJZ. Similar engraving would be done for other stations, so that the user of the instrument would have only to turn the knob to find the correct station, and where it would then come in at its maximum strength.

(Continued on page 515)

"It was a Human Leg and the Delicacy of the Fingers Showed Without Doubt That it Belonged to One of the Fair Sex, and a Very Young Person at That. This was Further Confirmed by the Beautiful Silk Hose and the Delicate Venetian Point Lace That Encircled the Limb. Gradually Before the Astonished Eyes of the Spectators, the Trunk and Arms Appeared, and Finally the Head, the Face Being That of a Beautiful Young Girl of Twenty

# Doctor Hackensaw's Secrets

## By CLEMENT FEZANDIÉ

"WELL, doctor, what new invention are you working on now?" asked Silas Rocket as he entered the laboratory one fine spring morning.

Doctor Hackensaw removed his spectacles and carefully wiped them, as he answered:

"I am working upon one of the most important of the electrical problems that still remain to be solved—the *electrical transmission of bodies*."

"You mean the sending of objects from one place to another by electricity?"

"Precisely. Ever since I was a boy, I read Faraday's account of his electrical researches, I became convinced that the conveyance of bodies from place to place by means of the electrical current was not only a possibility but had even been accomplished already."

"What?"

"Certainly. When we silver-plate an object, we put the object to be plated at one end of a tub and a bar of silver at the other end. The electrical current carries the particles of silver from one end of the tub to the other—in other words, we have an actual transmission of matter from place to place by electricity. It was Faraday who suggested the name of *ions* for the particles that are thus carried."

"Yes, but in silver-plating the silver particles have only a few feet to travel. Electrical transmission would be useless unless you could send bodies a considerable distance."

"True, but the question is only one of degree. Hertz sent wireless waves a few feet and Marconi who came afterward had little trouble in sending them thousands of miles. My problem was similar to Marconi's. The first step was already made. I had merely to increase the distance the ions should travel. I realized at once the importance of the subject, for transportation charges form an important item in the price of almost every article of merchandise, and anything that would cheapen transportation would help reduce prices."

"But is not electrical transmission expensive?"

"Not if we use the waves of the ocean for generating our electrical power. We have there a practically inexhaustible source of energy. Besides, some goods are wanted in a hurry, and think of the time that would be saved in sending an object from New York to San Francisco by telegraph instead of by train!

"My first attempts, however, were not directed toward sending solid bodies by wire. I chose a simpler problem—namely that of sending electrical impulses. You know how the stock ticker works. One man sends a

(*Continued on page 401*)

### —No. 8—
### The Secret of Electrical Transmission

*Author's Note.—The problem of sending bodies from one place to another by electricity is one that is certain to be solved at no distant date. We can, at present, send bodies a few feet in this manner, for in the process of silver-plating, the ions or particles of silver travel several feet through the electrolytic liquid. The "atomic or ionic" slowness of their progress is too great for a long journey. But some future genius will undoubtedly find electrolytes offering less resistance to the quick passage of the particles.*

*To send the particles by wireless is a much more difficult problem. Undirected wireless would, of course, be out of the question, as the particles would be scattered in all directions. But why might not the ions be transmitted by directed wireless. If we admit the corpuscular theory of light—and, in my opinion, this is the only real theory offered, there seems no possibility in our being able some day to send a solid body from one spot to another by wireless.)*

# Restoring the Moon

By BURNIE L. BEVILL

My chum, Paul Smith, and I are members of that esteemed fraternity known to the public as *reporters*. At the time the event which I am about to describe occurred, we were officially connected with the New York *Gazette*," which was, the year 1933, the leading newspaper of the country and our business was to "get the news, whatever it happened to be. We were established in the Ow[illegible] Apartments at this time and—strange to relate with regard to reporters—were taking a rest.

I remember well the Sunday afternoon that Paul and I were in our cozy bachelor quarters discussing some scientific matters of the very deepest nature and I am quite sure now that neither of us possessed a very clear understanding of our subject. However we were discussing inter-atomic force, discussing it in a somewhat disinterested manner little knowing that the subject was going to claim our closest attention within a very short time.

"I say Jim," burst out Paul after a brief lull in the conversation, "what do you think of this new idea that there is such a thing as inter-atomic force? Sounds like rot to me."

"Well, of all things!" I exclaimed. "The idea of one of your education talking in such a ridiculous manner! These days anyone knows that inter-atomic force exists, just as they know that radio waves exist, and you know that it's only a matter of some ten years since people began to understand radio."

"Well, then, suppose we talk about this new idea of Professor Conarie, that gravitation can be suspended by means of electricity, passing over a metallic screen. What do you think of that?"

"What do I think of it? Why, I agree with the professor in all respects," I replied. "And just think what a wonderful thing that will be to the working people mechanics, and so forth! I was just thinking how by his means automobiles and the like could be repaired. It would be necessary only to [illegible] them over the metallic screen and suspend gravitation beneath them. Then they could be raised to any height so as to facilitate repairing them underneath—no effort being required to raise them or to hold them at the required elevation."

"Yes," agreed Paul, "but suppose that when you raised the automobile as you say that you forgot to stop it at the desired place—why it would keep going up into the air there would be nothing to stop it. You know this is the first law of motion. And, furthermore, physiology teaches that it is gravitation that tends to maintain our equilibrium. If we did not have this force how would we succeed in this matter while we were in the gravitationless area working on the car?"

I had to give in to Paul, as I usually did upon such occasions, as he was always looking upon the dark side of matters of the kind, and managed always to bring in some objection to any suggestion that might be mentioned.

About this time Paul happened to pick up the morning paper which had been overlooked until now and glanced at the headlines.

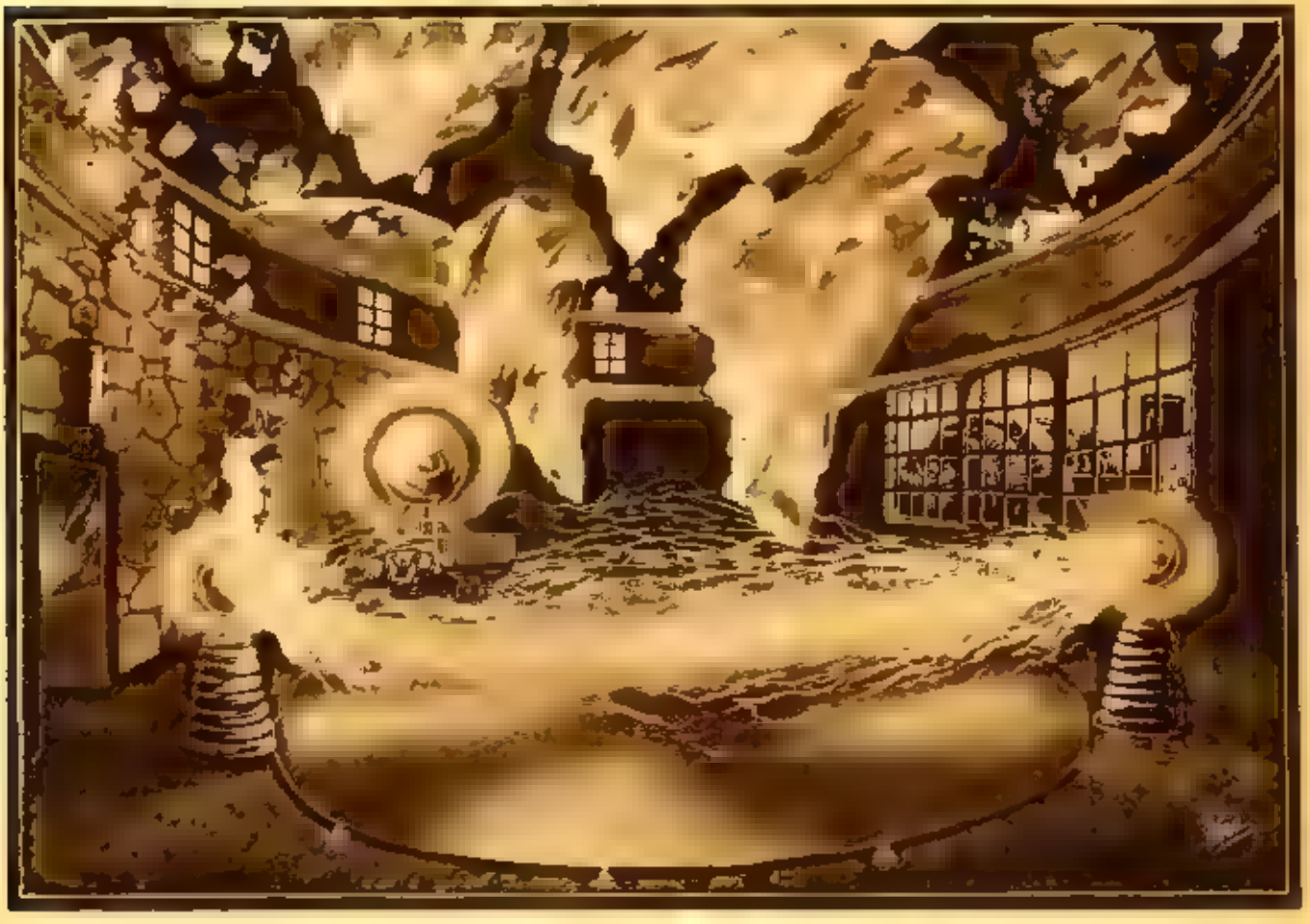
"Disturbance in the atmosphere. Pressure much lowered," it read. Leaning over his shoulder, I, too, read the article which ran:

"*Washington, D. C., March 22.* For some unknown reason the atmosphere has *greatly lowered in pressure during the night. From its normal pressure of fifteen pounds it has reached the enormous low of twelve pounds, and as has been quite unnatural it has caused the attention of several scientists of the meteorological department to be centered upon the reality. These men have come to the conclusion that there is some scientific madman at the bottom of the affair. Detectives have been warned to be on the look out for peculiar actions, and meanwhile every precaution is being taken that the culprit will soon be brought to justice lest he be the cause of serious damage.*"

"Well, doesn't that beat you!" Paul exclaimed. "The idea of some scientific maniac being at the bottom of such a business! How could it be possible?"

"Very reasonable. I quite agree with the meteorological experts in the matter." I

(Continued on page 45)



A Moment Later the Heavens were Opened, and with a Rushing Sound a Tremendous Object Fell from the Sky and Crashed into Stanas's Stone Structure, Shattering the Building to the Impact. We Now Observed That the Gigantic Object Strongly Resembled an Iceberg, and Upon Investigation We Learned That This Huge Mass was Nothing but Frozen Atmosphere That Had Been Sucked by the Intense Cold of Outer Space. Apparently, the Positive Charge Had Made the Disc Doubly Powerful, so That It Must Have Drawn the Huge Frozen Mass Upon Itself and Thereby Destroyed Itself Completely

# The End of the World--How Soon?

By IVAN L. SMITH

**Will the End of the World be Due to a Dark Star Colliding with the Sun, and Thus Destroying the Earth with a Hail of Fiery Meteors?**

**And her Theory of How All Life May Come to an End Is Based on the Supposition That the Action of the Oceans and Rivers Will be Such as to Disintegrate the Land Slowly and Eventually Wash it Into the Seas; So That in the Course of Time the Atlantic Ocean Coast Line Will be Changed As Here Shown**

HOW many times have you heard somebody exclaim, in commenting on some unusual disturbance "My goodness, I thought the world was coming to an end." Well, the world IS coming to an end. Just when this highly important event will transpire and just which of several possible forces will operate in bringing it about, we are not prepared to state, but no thinking individual doubts for a moment that some day this planet will no longer be the dwelling place of Life and may even cease to exist as a planet. Everything abstract or concrete of which we have any knowledge seems to develop in cycles. Plants grow, wither and die; animals are born, reach maturity, decline into old age and die; states rise from small beginnings, reach their zenith, decline and fall; whole species evolve from simple beginnings into highly complex organisms, then gradually degenerate and are exterminated in the universal struggle for existence. It is generally believed that our entire solar system, including our own little planet, is pursuing the same course of development we can observe going on all around us. We speak of "the everlasting hills," and the geologists tell us that the "everlasting hills" are standing on the site of ancient seas.

Nearly every group in society believes that the earth had a beginning. The theologist's theory of the Creation may be found in Genesis. The scientific theory differs from the biblical version somewhat, since it hypothecates the gradual evolution of the sun, the earth, the other planets and their satellites from a cosmic nebulous mass of widely diffused gaseous matter. The "nebular theory" was first advanced by the French mathematician Laplace, and stood up under adverse criticism for nearly a century. Professor Chamberlain of Chicago University has recently

evolved the "planetesmal hypothesis" which meets many of the objections raised against the nebular hypothesis. Both hypotheses, however, take the gaseous nebula as their starting point, differing only in the method by which the sun and planets were subsequently formed from this common beginning. There is not room in an article of this length for further discussion of these highly interesting theories.

The point to the whole discussion is that the earth had a definite beginning. It is just as certain that the earth has had a gradual development or growth. Here again the temptation to digress is felt. Geologists have pieced together such an engrossing history of the past life of our earthly abode that the only way to avoid wandering far afield is to avoid the subject altogether and to simply state that the earth reached its present state through gradual evolution from a gaseous mass.

Since the earth had a definite beginning and a gradual development, we must assume that it is going to have a definite end if the analogy is to be complete. It is not a question so much of whether or not our earth will some time cease to exist as it is a question of the causes which will operate to bring this about. We may observe several forces at work which, if allowed to continue at their present rate will some day render our globe unfit for habitation.

Life cannot exist without water. The amount of water needed to support some forms of life is relatively small, but no forms known to us exist without some water. If, therefore, moisture should completely disappear from the face of our planet, said planet would cease to be of any great value as a dwelling place for human beings. Water is gradually disappearing. This highly important article is composed of a compound of two volumes of hydrogen to one volume of oxygen. Our planet started on its career provided with a definite amount of these two elements in various combinations. Only an insignificant amount has since been added through the influx of meteorites, none of which has been in the form of water so that the permanence of our water supply depends on the earth's ability to hold on to the store of oxygen and hydrogen with which it was originally provided. This ability in turn depends on the relation existing between the earth's gravitational pull and the velocity attained by any object on the earth's surface.

It has been figured that any body having the size and mass of the earth exerts a gravitational pull sufficient to hold any object traveling at a speed of less than 6.9 miles per second. This figure represents the *critical velocity* of the earth, and measures the limit of the earth's ability to hold the elements composing it. The critical velocity of Mars is 3.1 miles per second, and of the moon only 1.5 miles per second. Any particle of matter attaining a speed in excess of the critical velocity of the parent body is free to leave it and wander at will until it bumps into some other body having an attractive force sufficient to hold it.

According to the kinetic theory of gases, every molecule of gas is assumed to be in incessant motion at different velocities, and these velocities may be enormously increased by collisions of molecules with one another. Clerk-Maxwell has devoted considerable time to a study of the maximum speeds attainable by the molecules of our commoner gases, and finds that hydrogen attains a speed of 7.4 miles per second, water vapor 2.5, nitrogen 2.0, oxygen 1.8 and carbon dioxide 1.6. Now these figures may be tiresome but they are highly significant. It will be noticed that the maximum velocity of hydrogen is 7.4 miles per second or .5 mile per second greater than the critical velocity of the earth, which means simply that every molecule of hydrogen is going to get up speed enough sooner or later to leave this earth of ours and go traveling through space on its own hook. That this actually happens is proven by the fact that no free hydrogen exists on the earth. Our total supply of this element is locked up in combinations with other elements which hold it fast. As further proof, it might be noted that the critical velocity of Mars is dangerously close to the maximum velocity of water vapor and the Martian water supply is admittedly scanty. It should also be noted that the critical velocity of the moon is lower than the maximum velocity of any of our atmospheric gases and scientists are agreed that the moon has no atmosphere.

From the above it will be seen that whenever water is separated into its constituent parts of oxygen and hydrogen, the hydrogen soon disappears, leaving only the oxygen free or in compound. There are several ways in which the combination forming water may be broken up. The most common way is to pass an electric current through it thus liberating hydrogen and oxygen. This reaction takes place whenever we have a rainstorm accompanied by lightning. Various chemical reactions also result in the freeing of hydrogen. Thus sodium, potassium, calcium and various other elements, when brought in contact with water unite with the oxygen and free the hydrogen. This also happens, for example, when steam is passed over heated zinc, iron, or carbon. It is true that there are chemical reactions constantly in progress which result in slight additions to the total water supply, but there can be little doubt that if a balance were struck, it would be found that a net loss results which, while inconsiderable from year to year is bound to reach serious proportions as the earth grows older. We are not justified in considering the present extent of the continents compared to their extent in previous geologic periods as proof of a diminishing water supply because there are too many possible factors which could involve a change in the relative proportions of sea and land, but it is nevertheless a fact that at present the seas cover a smaller area than they have at almost any period in the past. It is also true that transcontinental railroad lines are now running along the routes once followed by wild, rushing rivers.

Paradoxical as it may seem, there is also a possibility that the human race may some day be embarrassed by too much water. The high spots of the earth are being continually worn down by erosional agencies, and the materials composing them deposited in the sea bottoms. It is believed that there is a compensating movement deep in the earth which tends to move earth matter from under the sea floor back to a point beneath the land masses, thereby effecting a re-elevation of the worn-down land masses, and making possible a resumption of the erosional work of water, ice and wind. If the re-elevation were always proportionate to the wearing down which followed it, there would be no cause for alarm, since the average height of the land masses over a period of thousands of years would remain constant. There is reason to believe, however, that this is not the case, but that with each cycle, the material underlying the land masses becomes a little denser and the re-elevation is accordingly a little less marked. If this process were allowed to continue indefinitely, we might well expect to reach the point where the re-elevations were insufficient to keep the continents above water, and we should have an unbroken ocean covering the whole globe. This condition would not necessarily doom the planet as a dwelling place for life but it is certain that any remnant of the human race would have to undergo considerable modification, if it were to survive such a total submergence.

The most widely accepted theory of the probable end of our planet takes the gradual loss of the sun's heat as the cause. For many years it was believed that the sun's heat was the direct result of combustion. When scientific instruments had been sufficiently de-

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The Opposite Theory to the One Involving the Cessation of Life on Our Earth, Caused by All of the Elevated Land Being Washed into the Ocean as That in Which the Groups Above are Shown, Thus Covering All the Water on the Surface of the Earth Takes Place. When for a Time People Will Live on the Ocean Bed as Well as on the Land Now Occupied. Finally Total Extinction Occurs by This Theory, Due to the Lack of Water.

The Scheme Illustrated Above for Making Perspective Motion Pictures is That Recently Evolved by a French Inventor, Mr. Caesar Parolini. The Secret of Taking These Perspective Pictures With a Standard Movie Camera Lies in the Particular Method of Lighting the Actors and the Furniture or Other Properties Used in the Scene. The Floor and Background are Made of Black Velvet, and All that is Photographed on the Film are the Images of the Actors and the Furniture. The Much Desired Effect of Relief and Perspective is Intensified by the Use of Ultra Powerful Electric Lights.

# Perspective Motion Pictures

THE accompanying illustration shows one of the latest advances in the motion picture art made by a French inventor, Mr. Caesar Parolini, whereby a perspective or relief effect is obtained in a simple manner. When these motion pictures are thrown on the specially devised stage, fitted with a transparent screen, and a movable scene for the background, the actors appear to stand out in relief, the same as in the old parlor stereoscope we used to use in our Grandma's day. The top illustration shows the arrangement of the studio stage in taking the perspective motion pictures, the actors and furniture being illuminated by powerful electric lights, while all of the acting takes place in front of a so-called tunnel or chamber which is lined with black velvet. The floor is also covered with black velvet, thus giving the effect of bold relief and when the film is developed, and a positive printed in the usual manner, the mysterious effect is obtained of seeing simply the furniture and actors themselves, but no background whatever.

We now come to the theatre where the perspective motion picture so made is to be projected on the screen. A special stage arrangement is used, which is however quite simple, comprising a movable background scene or series of scenes, which can be moved into position while captions are being flashed, or at other opportune moments while the false floor covered with black velvet causes the images of the actors, furniture etc., to stand out as in full relief as if they were really being supported by the floor. The illusion of actual perspective is said to be perfect and also there is a marked reduction in the fatigue on the eyes.

As can be seen by looking at the illustration, the motion picture is projected on to a semi-transparent screen, placed at the stage opening or proscenium, so that the strongly illuminated background scene is readily observed through the semi transparent front screen, the whole effect blending together harmoniously.

By painting a long continuous panorama scene on canvas placed on vertical rollers,

As Shown in the Illustration Above the New French Perspective or Relief Movies are Projected on a Transparent Screen Placed in the Front of the Theatre Stage. The Background Scenery is Painted on a Canvas Strip, so as to be Rolled up, and the Successive Scenes are then Readily Moved into Position, by Turning the Rollers Either Manually or by an Electric Motor Controlled from the Projecting Booth. The Inset Photo Shows How the Images of the Actors and the Furniture Appear in the Film, no Background or Floor Being Visible

back of the transparent screen in the position shown, such scenes as an automobile racing along a road can be projected successfully, or such other scenes as a railroad train speeding along through changing scenery et cetera.

By using some form of synchronous electric motor connected to the rollers on which the canvas scenes or panorama is supported, and connecting this with a proper control switch mechanism mounted on the projecting machine, it is possible to change the scenes automatically as the presentation of the photoplay takes place. This automatic feature could be further developed by having special index perforations on the edge of the film at intervals, where the scenes are to be changed, so that at the close of one scene and just as a caption is to be presented, the synchronous motor on the stage will start in motion and revolve the rollers sufficiently to bring a new scene into position during the dark period, while only the caption is shown on the transparent screen. This scene change would be timed to take place in the period occupied in flashing the caption, and as the next scene started, the proper background would be in position.

The appearance of the actors' images on the positive film is seen in the photograph reproduced herewith, taken from an American film play "Hidden Dangers," featuring Miss Jean Paige. No floor or background is perceived in the film or projected picture, as becomes evident, this being taken care of by the special background scene, either moving or stationary, as already described.

There have been a number of American inventors who have spent considerable sums of money, in endeavoring to work out a simple and satisfactory method of producing a perspective or relief effect motion picture, and several of them have achieved considerable success, the editors having been present at one of the exhibits sometime ago which seemed to possess great promise. One of the interesting features of the present French invention, lies in the fact that the background scenery may be finished in colors, and if a colored film or tinted film containing the actors' images is employed, a very magnificent effect can be obtained.

The perspective or relief effect in motion picture reproduction is very desirable from many different points of view, not only reducing the strain on the eyes, but also giving the audience a much truer and more enjoyable presentation, and finally, when they are coupled to a phonograph or other speech reproduction mechanism, it will be found that these relief movies will give a much better effect than where the ordinary flat screen movies are used with the talking attachment.

# America's Fast Mine Layers

By GRASER SCHORNSTHEIMER
NAVAL EXPERT

NEW weapons of war are constantly being developed in all countries. And this development is particularly rapid in the navies. For three centuries we have had naval mines. But up to a short time ago they were used almost exclusively for harbor defense and blockade purposes. Now various nations have high speed mine layers capable of going to sea with their fleets to lay mine fields directly in the path of an enemy.

The idea was first conceived by the British, who refitted several flotilla leading destroyers for the purpose. The leader *Abdiel* was with the British fleet at the time of the battle of Jutland. When the Germans had started their retreat, the British commander-in-chief ordered this vessel to encircle the enemy and to his complement of mines as their path.

Proceeding at top speed, 32 knots, this vessel veered itself smartly around the van of the retreating Germans and laid her mines at a point of vantage. The result was that the battleship *Ostfriesland*, which was bombed and sunk by our airmen a short time ago, struck one and nearly went to the bottom. A large hole was torn in her side and it was only with the greatest difficulty that her crew was able to get her to a nearby port.

This proved the value of the type. The British refitted a number of other flotilla leaders and destroyers and the Germans built two very fast cruisers for that special purpose. However, it was not until the war was over that our Navy Department felt able to attack the problem. The result is that fourteen of our 1,190 ton type destroyers were converted into mine layers. These are the *Anthony, Barry, Hart, Ingraham, Jarvis, Lamson, Lea, Ludlow, Mahan, Manley, Murray, Specan, Stringham* and the *Reid*, the destroyer built as a gift ship at the expense of the Philippine government and which is manned entirely by Filipino crew.

However, on three of the ships one of the 4-inch guns has been removed.

The mine rails run from the sterns of the vessels to well amidships. It is understood that no less than eight of the large Mark IV mines are carried at one session. They are run along the rails on trolleys and are discharged from the stern through chutes. The mine itself, being about as much as a 14-inch shell. The charge consists of about 300 pounds of T.N.T. The mine itself is spherical in shape, having a diameter

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How Our New U. S. Mine High Speed Mine-Laying Ships Can Lay Down One or More Mine Fields Behind a Smoke Screen, So That an Advancing Enemy Fleet Will Be Wholly or Partially Destroyed. Defensive Submarines "D" Also Aid in Carrying Out This Maneuver. These New High Speed Mine Layers, One of Which Is Shown in the Act of Dropping a Mine (See Inset Photo), Can Obtain a Speed of Thirty-five Knots. These Mine Layers Can Carry One Dozen or More of These 1,400-Pound T.N.T. Mines. The Mine Is Held in Position by an Anchor or Base So That It Is Just Below the Surface, as Shown in the Picture. The Mine Is Fired When a Vessel Hits One of the Protruding Contact Pins.

All are of the same general type. They are over all 314 feet, the beam 34 feet and the draft 10 feet. At their load they displace about 1,300 tons. They are two-screw ships and their motive power is supplied by Curtiss geared turbines, which can generate 27,000 horse-power for a top speed of 35 knots. Steam is raised in four Yarrow oil-burning boilers. The complement is about 130 officers and men, although even the few boats now in service are being operated with 80 per cent of this number due to the Congressional cuts in the naval personnel.

Originally these boats carried four triple 21-inch torpedo tubes on their decks, but in order to make room for the mine rails they were removed. The main armament now consists of four 4-inch, 50-caliber guns and a single 3-inch, 23-caliber anti-aircraft gun. However, on three of the ships one of the 4-inch guns has been removed.

The mine rails run from the sterns of the vessels to well amidships. It is understood that no less than eight of the large Mark IV mines are carried at one session. They are run along the rails on trolleys and are discharged from the stern through chutes. The mine itself, being about as much as a 14-inch shell. The charge consists of about 300 pounds of T.N.T. The mine itself is spherical in shape, having a diameter of about three feet. The detonating apparatus consists of a set of plunger pins, the ends of which explode when in contact with any solid object. These detonators are protected by a special safety plug, which is withdrawn when

Let us consider a typical destroyer operating with the main fleet in action. The commander of the fleet orders them to the protection of a powerful battleship fleet of battleships and also to cruisers. Some cruisers and planes have searched out this fleet and ascertained its strength and disposition. The mine layers dash out at 35 knots and plant a double row of mines across 4,000 feet of the path of the advancing fleet under the cover of a destroyer smoke screen.

(Continued on page 596)

# A Motor-Driven Parachute

## By ERIC D. WALROND

A FALL in an airplane in Flanders, a broken arm and ribs, and several weeks in a hospital in Nice, gave Dr Hubert Julian, a West Indian Negro, a first lieutenant in the Canadian Air Corps during the war the idea for a parachute invention that is destined to revolutionize the science of aeronautics.

At the age of thirteen Lieut Julian, who is the son of a wealthy cocoa planter in Trinidad, B W I, won a trade scholarship, and was sent to England to study automobiling and mechanical science. He is an expert mechanic. There he became interested in aviation, and learned to fly.

After two and a half years of experiment, during which the practicability of the parachute was demonstrated, Lieut. Julian applied to the United States Patent Office for a patent. In the estimation of Commissioner Robert Fulton, the invention was the kind that the aeronautical world had long been in need of. Demonstrations were held and its practicability established.

The device, as explained to the writer by Lieut Julian, consists of a parachute built like an umbrella and mounted on the top of the plane, and of a motor-driven fan below it to force air into the parachute. It relates to new and useful improvements in safety appliances for airplanes.

The primary object of the invention, said Lieut Julian, is the provision of a safety appliance for airplanes so constructed as to prevent the machine from falling in case of engine trouble, and thereby preventing resultant damages by the machine or injury to the occupants.

Another feature of the invention is the provision of a machine having a collapsible parachute attachment secured thereto and positioned above it, together with means for raising the said parachute attachment from inoperative to operative position.

A further object of the invention is the provision of a safety appliance for airplanes, including a parachute attachment adapted to be secured thereto and which is normally disposed in closed position, together with a suitable fan or propeller adapted to raise the said parachute mechanism to its extended position when desired.

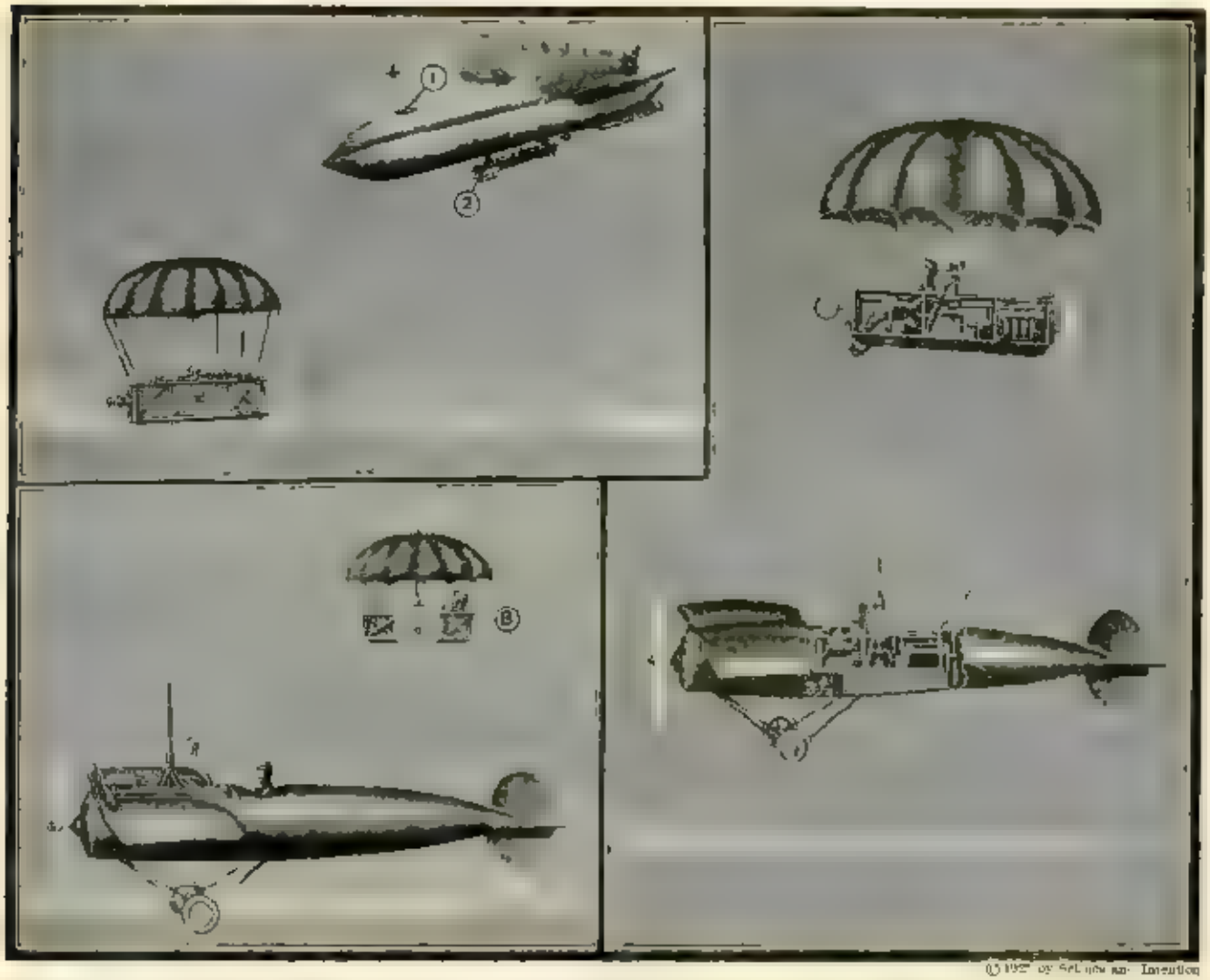
A still further object of the invention is the provision of a safety appliance for airplanes which will be comparatively simple and inexpensive to manufacture, reliable and efficient in use, and readily operated.

In case of engine trouble, it was explained, or any other difficulties which would cause the machine to fall to the ground without control, the motor is set in operation, which rotates the horizontal fan with sufficient rapidity to raise the parachute from the deflated position to full inflation, and the speed of the fan is so controlled that the air driven against the under side of the parachute will allow the machine to descend gradually and without danger of injury thereto or to the occupants.

From the description given above, and the accompanying illustration, it will be seen that a safety appliance for airplanes is provided which will fulfil all of the necessary requirements of such a device.

The parachute may be made to function as a separate device, being fitted with a small gasoline engine, fuel tank, etc so that the parachute is dirigible or controllable, enabling the flyer to steer it in any direction. It can be used on dirigible airships as well as airplanes.

In October of the present year the company is planning a great aeronautical pageant to be held at the Glenn Martin fields in Cleveland, at which prominent airplane manufacturers will be represented.

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A "Motor-Driven Parachute" Such as That Illustrated, to Aid Aviators in Descending Safely From a Burning Dirigible, as Shown in the Upper Left-Hand Picture, or Else From an Unmanageable Airplane, as Shown in the Two Lower Pictures. In Some Cases Riding in New and A Device Which Possesses a Great Deal of Merit. With the Ordinary Parachute One Cannot Land Where He Chooses, Because He Is a Victim of Air Currents and May Be Blown into a Tree or Far Out Over Water, Etc. This Motor-Driven Parachute in One Form Is Built as a Part of the Airplane Fuselage, But Is Caused Released by Pressing a Trigger. The Vertical Fan, Driven by the Auxiliary Parachute Engine, Helps to Quickly Inflate the Parachute Envelope While the Propeller, Together With a Rudder at the End of the Parachute Cradle, Enables the Pilot to Steer the Craft as Desired

Mr. H. Gernsback Has Proposed That We Build a Gigantic Monument to "Electricity" On Some Plateau We Could Erect an Electrical Generator Molded in Concrete 1,000 Feet High. Molded of the Finest Concrete, Such a Monument Would Last for Thousands of Years.

It Would Probably Not Be Affected by the Weather and the Climate, and It Is Doubted Whether It Could Be Easily Destroyed by Any Savage Race That Might Come After Us. In the Inside Passages, Along the Walls, Could Be Inscribed Diagrams and Other Electrical Fundamentals from the First Static Machine Down to the Latest Radio Developments. As New Inventions Come About, These Can Be Inscribed from Year to Year.

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# Electricity's Monument

## By H. GERNSBACK

In connection with our editorial of this month we show on this page a monument dedicated to the age in which we are living. Electricity, more than anything else has made our present civilization what it is. Should this civilization of ours be wiped out by war or some other catastrophe nothing would remain to tell what Electricity has done for the race during the last century.

Before the Egyptians built their pyramids they probably foresaw that unless they built something of a tremendous size it would not stand the ravages of man and Nature. Hence the size and form were chosen in such a way as to make it last for practically all time.

When we therefore propose to build a gigantic monument to Electricity, we have the same objects in mind. On some plateau we could erect an electrical generator, molded in concrete 1,000 feet high. Molded of the finest concrete, such a monument would last for thousands of years. It would probably not be affected by the weather and the climate, and it is doubted whether it could be easily destroyed by any savage race that might come after us.

In the inside passages, along the walls, could be inscribed, in diagrams and otherwise, electrical fundamentals, from the first static machine down to the latest radio developments. As new inventions come about, these can be inscribed from year to year.

If the entire electrical industry would think well of such a plan, a monument of this kind could be built without taxing any one concern a great amount. It would be a lasting tribute to our race, and to the progress that is exemplified by Electricity.

# Blue and Yellow Light Have Same Speed in Space

The chances are five to one that the difference in the time of passage of blue light and yellow light through empty space is less than one second in 300 years, according to a result just announced by the Harvard College Observatory. It is inferred from this result that there may be no difference in velocity whatever.

The new and extremely sensitive test of the relative velocity of light of different wave lengths is made possible, it is stated, by the recent determination of the distance of a remote globular star cluster named Messier 5 and by the completion at Harvard of a long study of the variations affecting the light of some of the cluster's brightest stars. The distance of Messier 5 is 22 kiloparsecs which is the equivalent of two hundred million billion miles. It takes light nearly 40,000 years to travel across the space between the star cluster and the earth.

From a study of photographs made at the Harvard astronomical station at Arequipa, Peru, a large number of variable stars have been found in this remote star swarm. The changes in the lights of these variables have been studied at Harvard, and more recently several series of photographs of the cluster were made with a big reflector at Mount Wilson, California, using plates sensitive to blue light and to yellow light. The time of the brightening of the variable stars was then determined separately for the two colors, but no difference in the time of arrival of the blue and yellow pulses of light was found at the end of the journey across empty space—a journey that has taken the last 400 centuries.

The uncertainty of the measured result is so small according to Dr. Harlow Shapley director of the Harvard Observatory, that he finds the chances are twenty to one that blue and yellow rays differ in velocity by less than two inches in a second while traveling through space at the rate of 186,000 miles a second.

Blue light is closer to the X rays and radium emanations in frequency or wave-length than yellow light, which approaches more closely the electrical waves. Whether the velocity of light changes with the color that is with its frequency or wave length, has been a disputed question among physicists and astronomers, although most of them believe that the velocity is constant. The velocity of light is 186,330 miles per second.

# A MONUMENT TO INVENTOR OF TELEPHONE

THIS illustration depicts a proposed monument to Dr. Alexander Graham Bell, the inventor of the Telephone who died recently. The idea of a monument was proposed by M. H. Gernsback, Editor of this magazine and the description follows:

Somewhere along Riverside Drive, New York or some other prominent point, a monument in the form of a telephone receiver from 200 to 250 feet high should be erected somewhat along the lines of the design shown. The monument would be built entirely of black marble or dark granite.

The interior would be built with the exception of the foundation on which the imitation telephone receiver rests. This bottom section could be fitted out as a museum with all the historical models of Dr. Bell's inventions which could be housed here for the benefit of visitors and students.

It would seem proper that the American inventors should get together and build a lasting monument of this kind by popular subscription. A voting coupon is printed on the bottom of this page where readers may vote as to their opinion on the plan outlined. It is thought that if every inventor in the United States would subscribe only $1.00 the monument could be built.

**COUPON**

I, the undersigned, am in favor of a monument for Dr. Bell as outlined in the October issue of SCIENCE AND INVENTION.

I would
I would not } be in favor of contributing a small amount to the monument. The signing of this coupon does not obligate me in any way whatsoever.

Name

Street

City State.

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November

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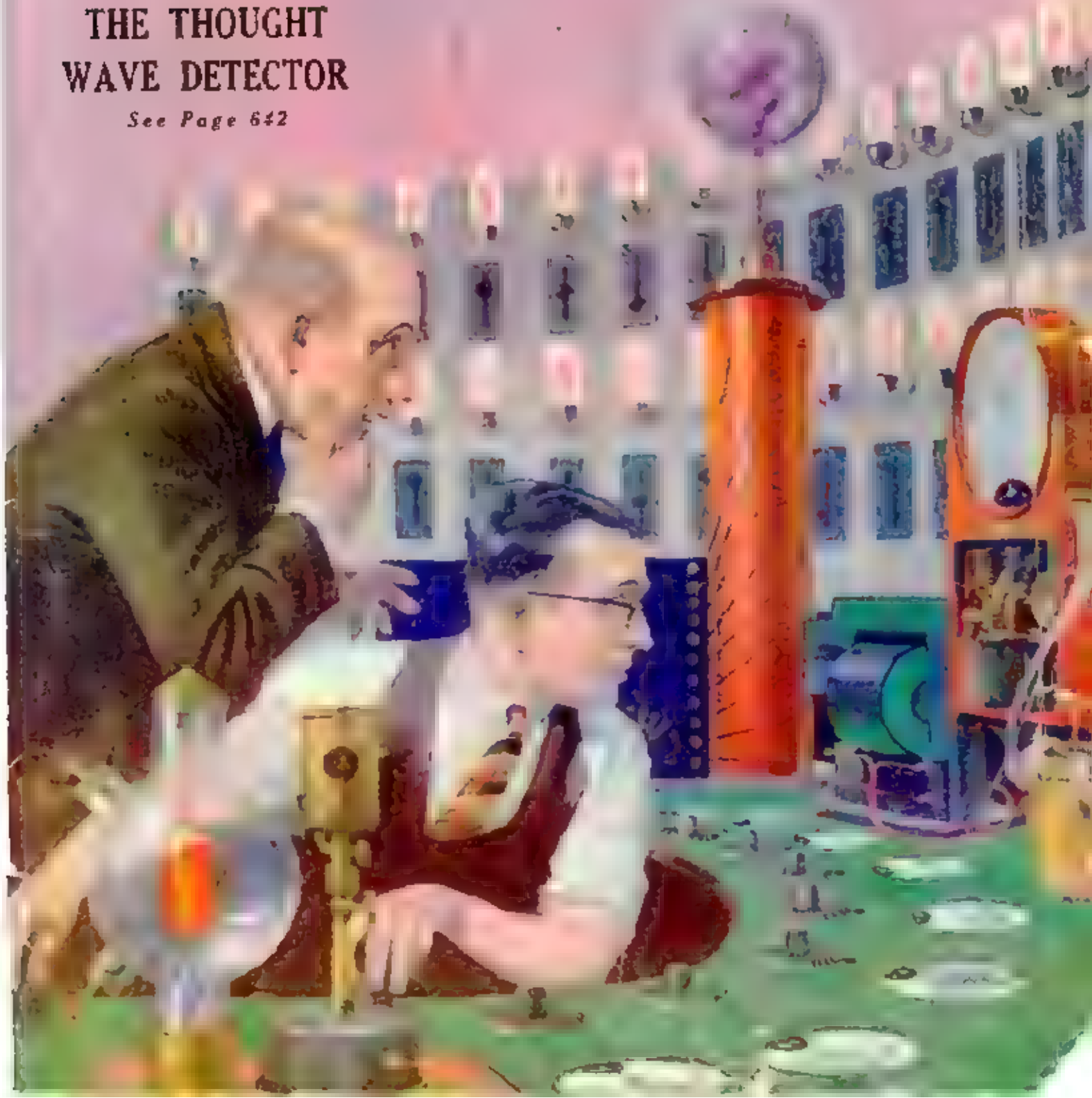
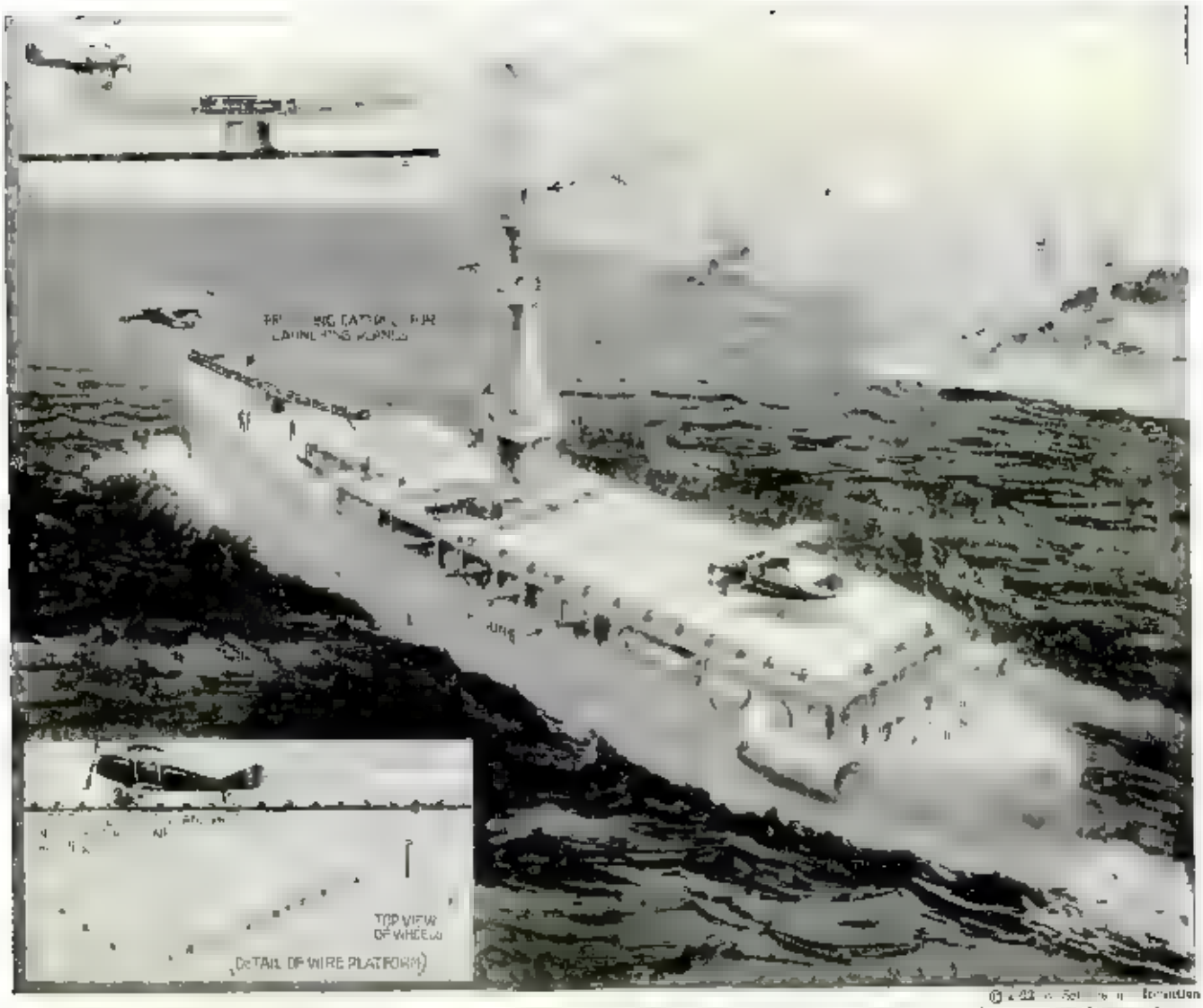
# Science and Invention

## THE THOUGHT WAVE DETECTOR

*See Page 642*






The Navy's Newest Airplane Landing Device Involves the Use of Steel Wires, Held Taut by Means of Springs on the Four Sides of a Frame, as the Diagram Makes Clear, so That a Regular Land Type Plane Runs Over With Wheels Gear Designed Quite Thus Platform and Is Stopped in a Short Distance. It Was First Tried Out on a British Navy Ship. The Wires Catch the Wheels as They Skid and Slide Over the Wheels After a Certain Tension Has Been Exerted Against the Wires. At Long Angles Wires Tend to Keep the Plane From Turning and Skidding Off the Platform at the Sides. The Action of the New Navy Gear Against the Accelerating Plane to a Speed of Sixty Miles an Hour in a Distance of Sixty Feet, Is Also Shown Both on the Ship and in the Upper Inset Diagram.

# Landing Airplanes on Ships

By GRASER SCHORNSTEIMER

NAVAL EXPERT

PROBABLY the most serious problem facing naval aviation today is the landing of airplanes on small areas, such as the flying deck of an aircraft carrier. Its solution will mean that land planes may be carried to sea with the fleet instead of the heavy seaplanes, which are slower and more awkward than the land type. Almost since the birth of this branch of flying various schemes have been tested and put to the test.

Finally, in 1917, the British hit upon a sort of trap to catch the plane as it touches the landing and to slow it down rapidly until it comes to rest. It is a wire field arrangement and the most successful of all the landing platforms yet proposed. Very successful landings have been made on the British aircraft carrier *Furious*, despite that vessel's funnel and superstructure which divide the landing platform in two parts. Another landing stage has been installed on the aircraft carrier *Argus*. This one is even more successful, because of the great field provided by the vessel's deck. However there are beautiful spills occasionally.

America was not slow in following up this British achievement. The Naval Aviation service began to experiment with a similar device at the flying station at Hampton Roads, Va., near the naval operating base. Not only was the wire stage studied but various other types of landing platforms were tried. At present the stage is reaching a high state of perfection and may be installed aboard the aircraft depot ship *Langley* almost any day. This vessel will then go to the Pacific fleet as aircraft tender.

Imagine a frame about 65 feet long by about 30 feet wide covered by crossed wires forming open squares about two feet across. This net sits one foot to one and one-half feet above the landing platform. Its wires are held outside the frame by unstretched springs, which keep the strands of the net quite taut.

A plane swings low over and finally upon the taut strands of the net at a speed of 35 or 40 miles an hour. As the wheels of the plane bump against the wires of the net the wires give, the springs yielding and allowing the wire to be drawn out. As the plane progresses one set of wires passes under the wheels and other wires engage them, retarding the advance of the plane across the net until motion ceases. Usually the plane is brought to a stop before it has covered more than three-quarters of the length of the net.

When these landings were first tried there were some bad spills. The planes turned over because of the impact on the front wheels and the lack of a holding down device on the tail. The speed of the plane caused it. In order to mitigate or in some way remedy this evil a pair of upturned hooks were fitted to the tails of the planes. These hooks catch in the cross strands of the net, drawing the wires up and these wires hold the tail of the plane down and as the plane progresses one strand passes out of the hooks and others engage them. In this way it has been possible to keep planes on almost an even keel.

Two of the six battle cruisers which are now on the stocks, but which we must not complete because of the terms of the Naval Treaty, may be converted to aircraft carriers. Congress has sanctioned the plan. It is proposed to mount these landing traps on them. Then we will have two 32,500-ton, 33-knot aircraft carriers of the first line. They will be capable of taking both land and seaplanes out to sea and both kinds of planes will be able to land on their decks.

# The Thought Wave Detector

## By THOMAS WILLING HICKS

You, of course, remember Monday, Nov 8th, 1918, when great mobs of people in every large city in the highly civilized sections of the world, [illegible] big Berthas still thundered [illegible] the rifles still cracked in the trenches the machine guns still spewed their hail of death, brother-man was, at that very moment, bayoneting his brother-man [illegible] carnage and grim pestilence, [illegible] danced the Devil's ballet of war.

Ninety two hours later the thing really happened. You know the armistice [illegible] and then the celebration all over again.

But what whispered the coming event to the tense nerve lobes in the brains of the mentally active humans, scattered throughout the length and breadth of the intellectual zones of the earth? How could they "feel it in their bones" almost a hundred hours in advance? Where, and how [illegible]

On [illegible] 11:50 o'clock in the morning [illegible] York was rocked to the pit of tophing by the bombs exploding in Wall Street. Three days, yes, even five to [illegible] previously [illegible] neurotic constantly under a high nervous strain and extreme mental tension, had caught the flash" and knew of [illegible] warning to his friends of the [illegible] disaster. How?

At exactly half past six o'clock (U. S. Central Time) on the evening of August 12th 1917 the family of George B. Mosure living three and a half miles southeast of the little village of Lyne, Washington County, Kansas, were all seated at the supper table. Suddenly Mrs. Mosure busily engaged [illegible] baby daughter with a glass of milk, turned deathly pale and wailing "Oh my poor, poor boy" swooned. When revived the first words spoken to her husband [illegible] "Daddy, our John will never come [illegible]" Forty-seven days later the Lyne, Kansas, telegraph operator borrowed the grocer's Ford and carried a message to the Mosure farm. Yes, it was from the War Department Washington D. C. and read laconically, as follows:

> Killed in action, Argonne Forest, Aug 12th, 1917 private Mosure John age 21. Next of kin Mosure, George B. Lyne, Washington County Kansas."

The family was, of course, not only deeply affected, but surprised—all but the mother. She had known it for twenty-seven long days—and nights.

Subsequent investigation and a careful check-up of the time difference between the Greenwich standard time zone in which the state of Kansas is located and the continental time zone in which the Argonne sector lays proved that Mrs. Mosure had *instantly* received the "flash" and knew her son had been killed as he went over the top at the zero hour of the August 12th offensive in France. How?

If proven possible to foretell, or foresee with scientific certainty the fluctuations of the New York Stock Market ninety hours [illegible] such movement could the New York Stock Exchange, as now constituted and as at present operated, continue to exist?

The human brain, the brain itself is a material substance, or a sort of a flesh muscular-mechanical part which acts by registering the effect or the action of a metaphysical thought. The real substance of this brain part is, like all other matter and material things, composed of atoms—atoms [illegible] The same is true of a piece of steel, or wood, or silver, or gold—all are atoms—atoms in definite molecular combinations. Strike the steel bar with a hammer and its molecules in the vicinity [illegible] struck are badly jarred, disturbed [illegible] immediately reverse their position with respect to each other. At a speed incomprehensible to the human mind, the former combination is changed.

Exactly the same thing occurs when an electric current is suddenly passed through a piece of matter which we call wire. In the case of the steel bar the rearrangement of the molecules of the steel are manifested by vibration and we say "it made my fingers tingle." In the case of the electric [illegible] flowing through the wire a rearrangement [illegible] ions, that, in turn, go to make up the thing we call wire, instantly takes place. This jolting and rapid change of combination of the electrons stirred up by the electric current rushing through the wire is manifested by a perfect flood of electro-magnetic waves, which are, in turn, recorded by our eyes as light, and which register on our bodies as heat.

Science has segregated and tabulated five different forms of electro-magnetic waves, namely light waves, heat waves, wireless [illegible] X-ray waves. The new wave to be added to this list, and by most important and far-reaching of all is the *thought* wave.

When that material thing composed of atoms and which we call "the human brain is "struck" by a thought, here is what happens. The group of the brain cells is affected exactly as are molecules in the bar of steel when it is struck, or the wire when it is subjected to the electric charge. In all cases molecules of the steel bar or of the wire or of the mucous membranes of the brain, are jarred, disturbed, distorted realigned and rearranged. Take, for illustration [illegible] charging it with magnetism molecules of the metal are polarized, as it were, in a certain position or direction and the magnet will pick up a nail, or any small iron object. Now strike this magnet enough sharp blows with a hammer, and then try to pick up even a very small piece and you find it powerless. The magnetic force is gone. The blow changed the position and condition of the electrons in its atomic structure and the magnetism went out with the electro-magnetic wave that flowed therefrom at the [illegible] the blow was struck.

Now the brain "struck" with a thought undergoes the same action. The former molecular combination of the part disappears and a new condition or combination is established. This, too, causes a wave—just as the tossing of a pebble into a pool causes a shock to, and a rearrangement of the electrons composing the hydro-oxygen molecules that make up what we call water—and a visible wave results.

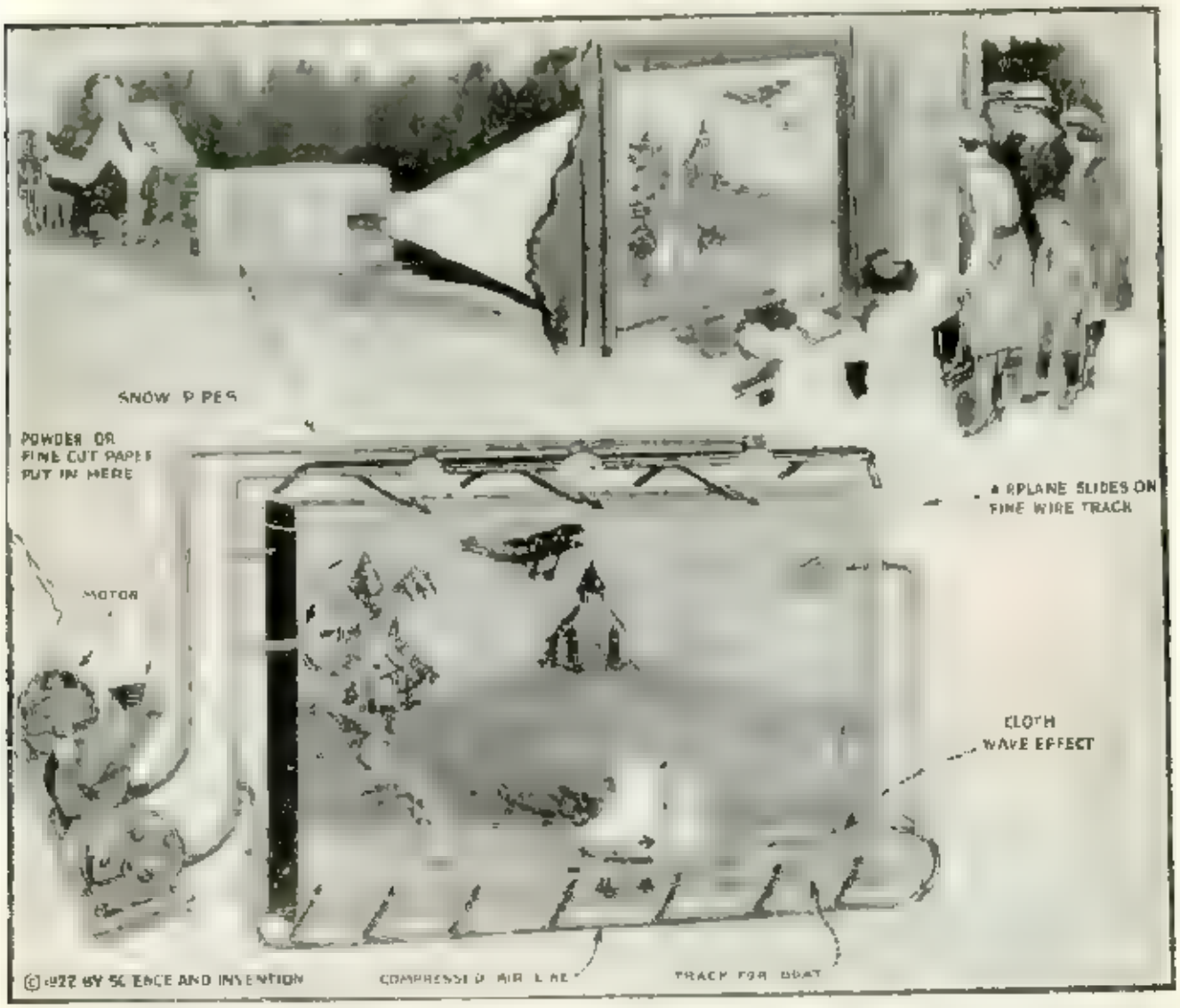
Now induce a healthy normal brain to perform the act of thinking. It thinks of some particular thing and a certain combination of the molecular structures of the brain cells is thereby formed. Now suddenly change the thought. Necessarily there is [illegible] rearrangement of the electrons composing the atoms which make up the molecules of the brain. The result is the creation of an electro-magnetic wave—a wave caused by the mechanical act of the material brain registering a change in the condition of the mind, or a metaphysical thought.

thought wave

(Continued [illegible])

[illegible]

# Animated Picture Projector For Show Windows




**One of the Most Recent Animated Show Window Displays We Have Seen is a Long Time In That Illustrated Above. Frederick W. Schmidt of Philadelphia, Has Recently Taken Out a Patent on The Device, and Some of the Effects Obtainable With It are Shown Above by Our Artist. Real Snow Scenes, Together With Moving Windmills, Clocks, Airplanes, Flags, Sailboats, All These Effects are Possible With This Fine Projector. The Outfit Comprises a Projection Lantern, Such as That Used for Projecting Postcard Pictures, and the Animation Takes Place on the Picture Placed in the Rear of the Lantern, as Shown in the Upper Illustration. The Effect of Snow, for Example, is Obtained by Placing Finely Cut Paper or Powder in the Hopper of One of the Blowers, so That This Material is Blown Out Through Nozzles Over the Top and Into the Floor of the Picture. Separate Outlets From the Blower Line Cause the Sailboat to be Blown Along on Its Track, as Well as the Airplane. The Vanes of the Windmill are Likewise Caused to Rotate, and the Flag to Flutter in the Breeze.**

ONE of the cleverest *animated pictures* projecting devices we have seen in some time is the one here illustrated, which was recently patented by Frederick W. Schmidt, of Philadelphia. The possibilities and variations of Mr. Schmidt's idea are practically limitless. Briefly considered, the apparatus comprises a painted scene with certain parts made movable, such as the blades on a windmill, a small boat, an airplane, etc., the picture is projected through the lens upon a screen in the show window by the reflection principle, similar to that used in the well-known postcard projectors. In other words, the light from powerful incandescent lamps is thrown upon the scene, and the reflected light is projected through the lens to the screen.

The moving parts of the scene, such as windmill blades, walking or dancing figures, etc., may be operated in a number of different ways, such as by clockwork or by electric motors. One interesting scene provided for in Mr. Schmidt's patent, is a snow scene. To produce the effect of falling snow, powder, such as flour or else very finely cut white paper, is fed into the hopper on top of one of the small motor-driven air blowers, and the flour or cut paper is carried up to the opening in the air delivery tube at the top of the scene, and thence is blown downward, in a very realistic manner.

The boat shown in the picture herewith, is blown along its course by a series of air jets operated from one of the blowers, and the [illegible] of the boat proper, having the [illegible] placed on [illegible] deck of carriage [illegible] which is running on a track. Among other possibilities of this invention, animated picture device intended for show windows and other advertising purposes, are rising or setting sun and moon effects. Another pretty effect in the animated picture is the waving flag, which is caused to flutter by a current of air from one of the supply pipes or tubes. An ordinary electric fan placed in a corner or other suitable position, gives a very realistic effect. It should have been mentioned that the track at the bottom of the scene runs continuously around the back so that the boat or other moving device, to be propelled along the track by jets of air, can return to the starting point repeatedly and automatically. The picture and its attachments are placed in an airtight casing, which is provided with an exhaust port.

Another departure shown by Mr. Schmidt, is that where a scene is made to continually change by virtue of being painted on a long strip of cloth, which is mounted on rolls, these rolls being rotated slowly either by air turbines propelled by jets of air from the blower system here shown, or else by an electric motor and suitable reduction gearing. In one of the scenes suggested by the inventor, for use in this animated picture frame, is one in which the scenery is made to move continuously while an automobile stands in front of the scene and the wheels spin merrily. The onlookers think that the automobile is moving.

December

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9 MAGAZINES IN ONE

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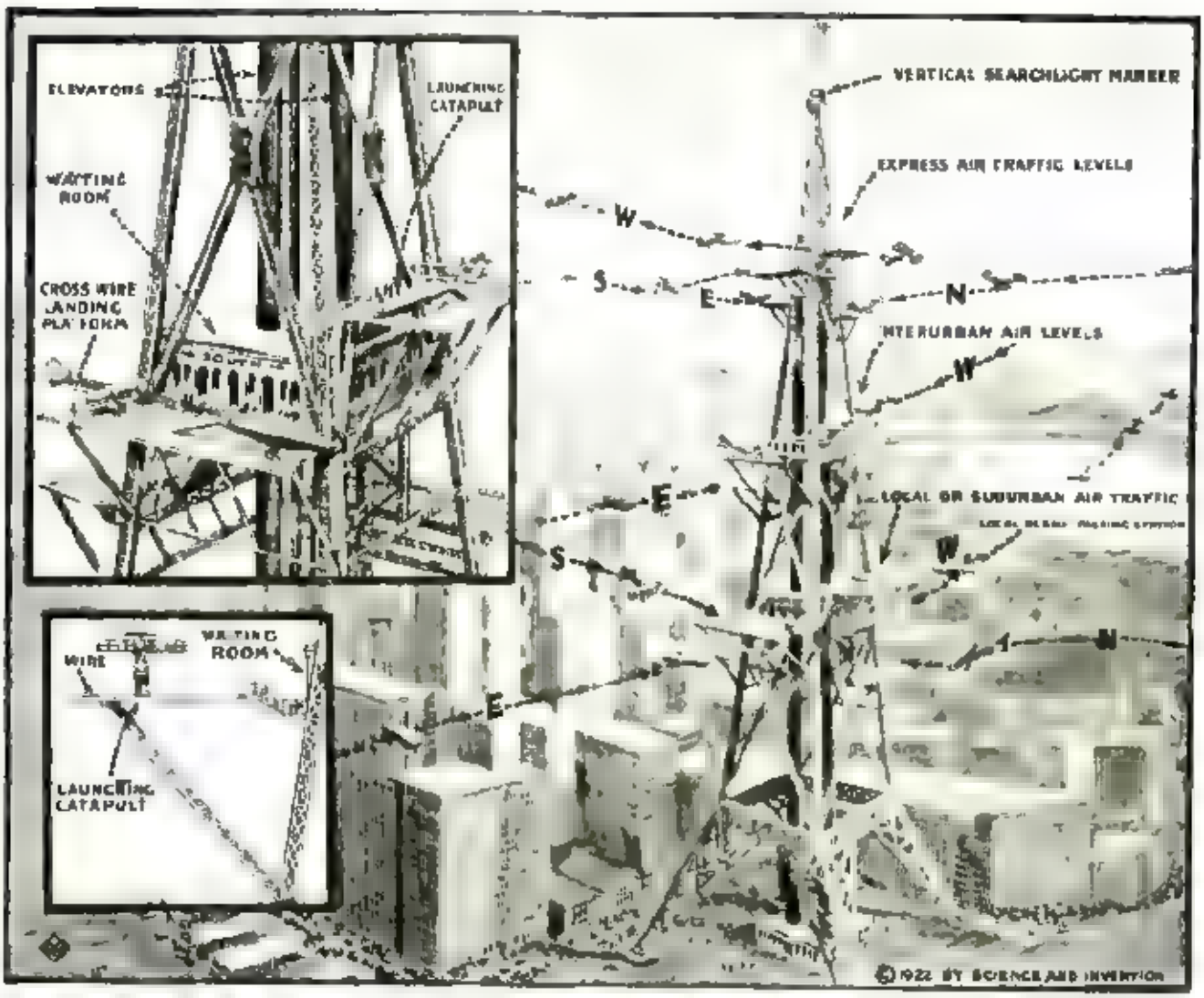
Motor Hints




Air Traffic of the Future Will Without a Doubt Become as Important a Problem as the Present Automobile Traffic on Our Main Highways and Streets. Gernsback and His Pioneer Aerial Structure with Landing Platforms and Wireless Control Station. Air Traffic Towers Will Be Used as Signal Stations for Day and Night Navigation. Automatic Searchlights Are Also Installed on These Towers. Aerial Traffic Will Probably Be Divided into Three Main Levels, as Here Shown. The Local or Suburban Level Is Used for Slow Speed Planes Flying at Low Altitudes. The Interurban Level Is Used for Medium Speed Planes Flying at Medium Altitudes. The Express Air Traffic Level Is Used for High Speed Planes Flying at High Altitudes.

# Future Air Traffic

By H. GERNSBACK

A

[illegible] will probably give the [illegible] levels, the Interurban

[illegible]

(Continued on Page 504)

The Possibility of Supplying Large Cities With a Pure, Invigorating Atmosphere Piped From Mountaintops Region Is Clearly Depicted in the Above Illustration. If the Methods of Procedure Above Outlined Are Still Further Elaborated Upon Cities Will Be Supplied With Mountain Air at Practically No Cost the Present Pipes Used for Supplying the Large Population With Water, Suitable to Conduct the Air Wherever Desired. The Inroads on Would Prove a Source of Constant Revenue, Inasmuch as Hotels and Theaters Using This Air Would Pay for It at a Certain Rate Per Thousand Cubic Feet

# Mountain Air Piped to City

## By JOSEPH H. KRAUS

"GO to the city to enjoy mountain air" is going to be the password in a few years, when country folk will be flocking to New York and other large cities for the purpose of inhaling the fresh, invigorating atmosphere of the mountainous resorts.

Does this idea seem absurd? Not at all. As the pure water of the New York Catskill region is now supplied to the city, and as such a supply is far cheaper than the water is, without a doubt, much better [illegible] supply New York with a pure, invigorating atmosphere from the mountains of the Catskill region, situated at a distance of 14 miles or more, and readily reaching the city at this point, and at another point at a cost of supplying the healthful mountain atmosphere to the population of the [illegible] city.

At present time the heat in New York is most intense. Here immense buildings with [illegible] generating plants are constantly [illegible] quantities of heat, in order to [illegible] the [illegible] in the sweltering pot. Some streets are narrow [illegible] buildings do not [illegible] [illegible] [illegible]

# "Dummy Observer" for Airplanes

## By ERNEST JONES

A SIMPLE method of photographing continuously on a strip of film air pressures, plus or minus, simultaneously at any number of points on the upper and lower surfaces of the wings of an airplane in flight is one of the recent accomplishments of the Army Air Service at its experimental plant at McCook Field, Dayton, O.

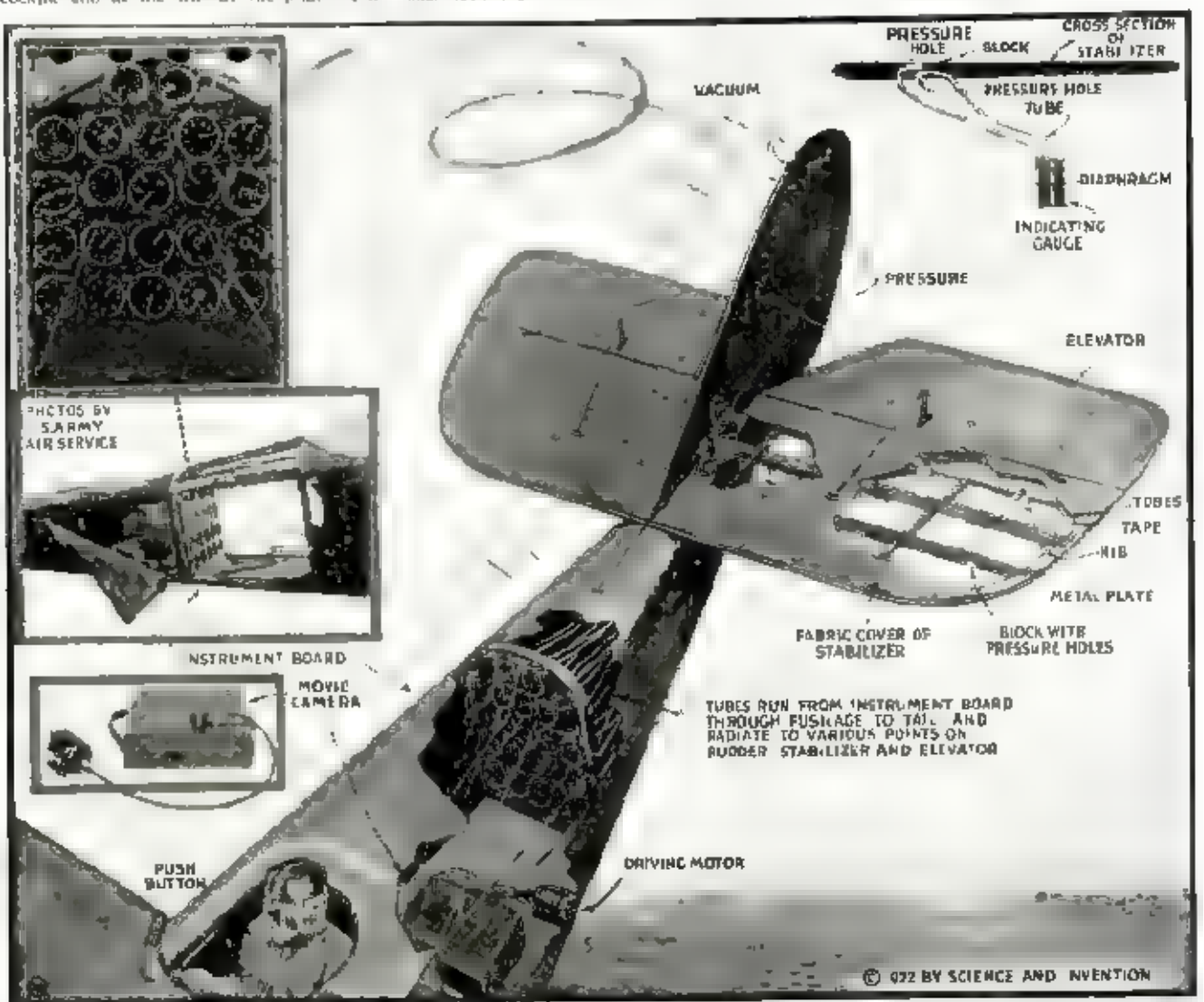
The measurement of these pressures is not unusual, but it is obviously difficult for a human observer to simultaneously record the readings of a number of instruments. The motion picture camera now plugging away at set intervals of time an entire battery of recording instruments.

A standard camera, used ordinarily in the motion picture industry for photographing titles, was directly driven with a small electric motor through a flexible shaft. The camera is lay flat opposite an instrument board placed in the fuselage of the airplane but with the gear box down to facilitate focusing through a sight glass. The motor was started and the camera put into operation by means of a switch in the pilot cockpit and at the will of the pilot. The measurements could therefore be photographed either in normal horizontal flight or in the course of turns, loops or spins or any other acrobatic maneuver.

The pressure distribution over the horizontal surfaces of the tail—rudder, elevators and stabilizers—was obtained by connecting the air pressure impulses shown on the instrument board on the film record by means of the surface to be investigated. The instruments were calibrated in pounds per square foot. The opposite sides of the diaphragm in these instruments were connected to the upper and bottom respectively (or vice versa, if necessary) of the surface to be measured. In other words, a surface which shows pressure on the bottom and suction on the top would have a resulting action integrated on the instruments and during flight the exposed film shows the instrument reading of the pressure at a particular point during any maneuver which the pilot chose to investigate.

The outer ends of the tubes which were flush with the surface were distributed and arranged over the stabilizer and elevator in such locations and distances as to obtain as complete information as possible. In addition to this, speed meters as shown, together with a dial to indicate the elevator setting were installed to give more complete information regarding the maneuvre.

The arrangement of the rubber air tubes here provided is very clever, but it would seem that some improvement on this scheme might be worked out, utilizing electric wires instead, which would not be subject to damage as easily as the rubber tubes. Microphones of special construction could be used as the pressure and vacuum detectors in the holes on the wing and tail surfaces, changes in pressure against the diaphragms of the microphones causing electrical resistance of the carbon grains to thin them to change and this resistance variation in turn being indicated on the galvanometers placed on the dial panel in place of the present gauges. It is peculiar in a way, that this rather simple idea was not thought of and employed a long time ago, as one of the hardest problems to solve in designing an airplane is to know beforehand just what pressures to design the various parts to withstand.




The Clever Arrangement of Pressure and Vacuum Meter Dials Here Shown, Installed on One of the U. S. Army Airplanes at McCook Field, Dayton, Ohio, Has Served to Place Valuable Data in the Hands of Flying Experts and Airplane Designers, Which It Has Never Been Possible to Accumulate Heretofore. It Would Be Humanly Impossible to Read All of These Meter Dials at Any Given Instant, and Not Only This But in Making Quick Turns and Studying the Resultant Pressures and Vacuum Effects on Opposite Sides of Tail and Wing Surfaces, an Observer Could Not Be Expected to Catch the Various Changes in Readings Occupying a Small Fraction of a Second. This Problem Was Finally Solved in the Manner Illustrated, viz., by Resorting to a Moving Picture Camera Driven by an Electric Motor, so That Whenever the Pilot Desires to Make a Record of the Meter Readings, He Has But to Push a Button in the Side of the Cockpit, Which Starts the Electric Motor Driving the Movie Camera. This Camera Lies in the Bottom of the Fuselage and One of the Movie Snapshots of the Meter Board is Shown in the Upper Left Hand Corner.

January

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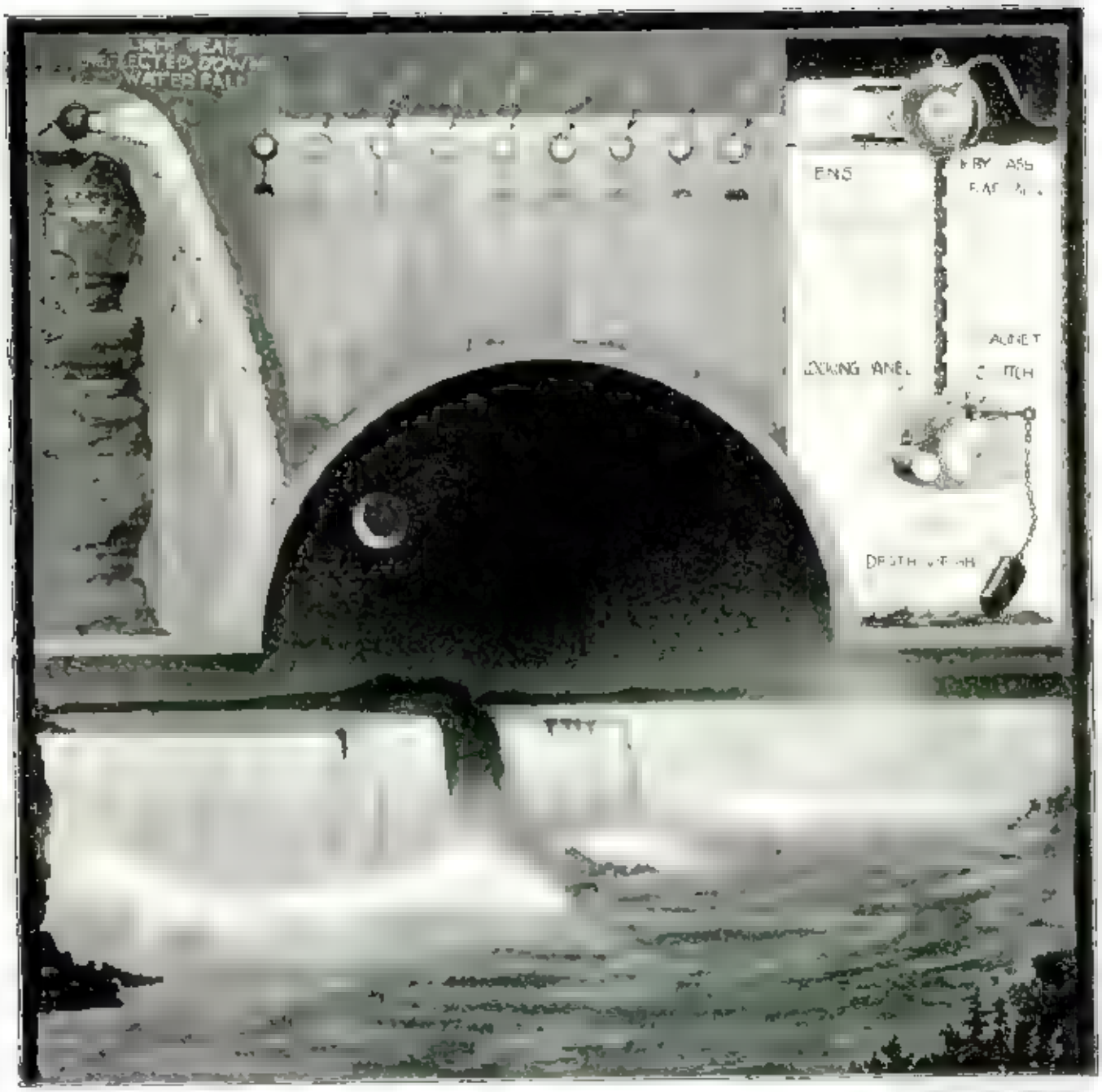
# Science and Invention




A Yankee genius has prepared a new scheme for illuminating Niagara Falls at night, using for the purpose submerged searchlights placed [illegible] to filter through the falling waters, on the principle which makes a ruby glass lamp shade [illegible] these light rays are effective both above and below the stream of water, as indicated by the dotted lines. [illegible] are held submerged by means of the arrangement shown at the [illegible]. The magnet [illegible] the [illegible] or buoys [illegible]

# Submerged Spotlights for Niagara

ONE of the [illegible]

[illegible] lamps and [illegible] the spectacle [illegible] the cliff [illegible]

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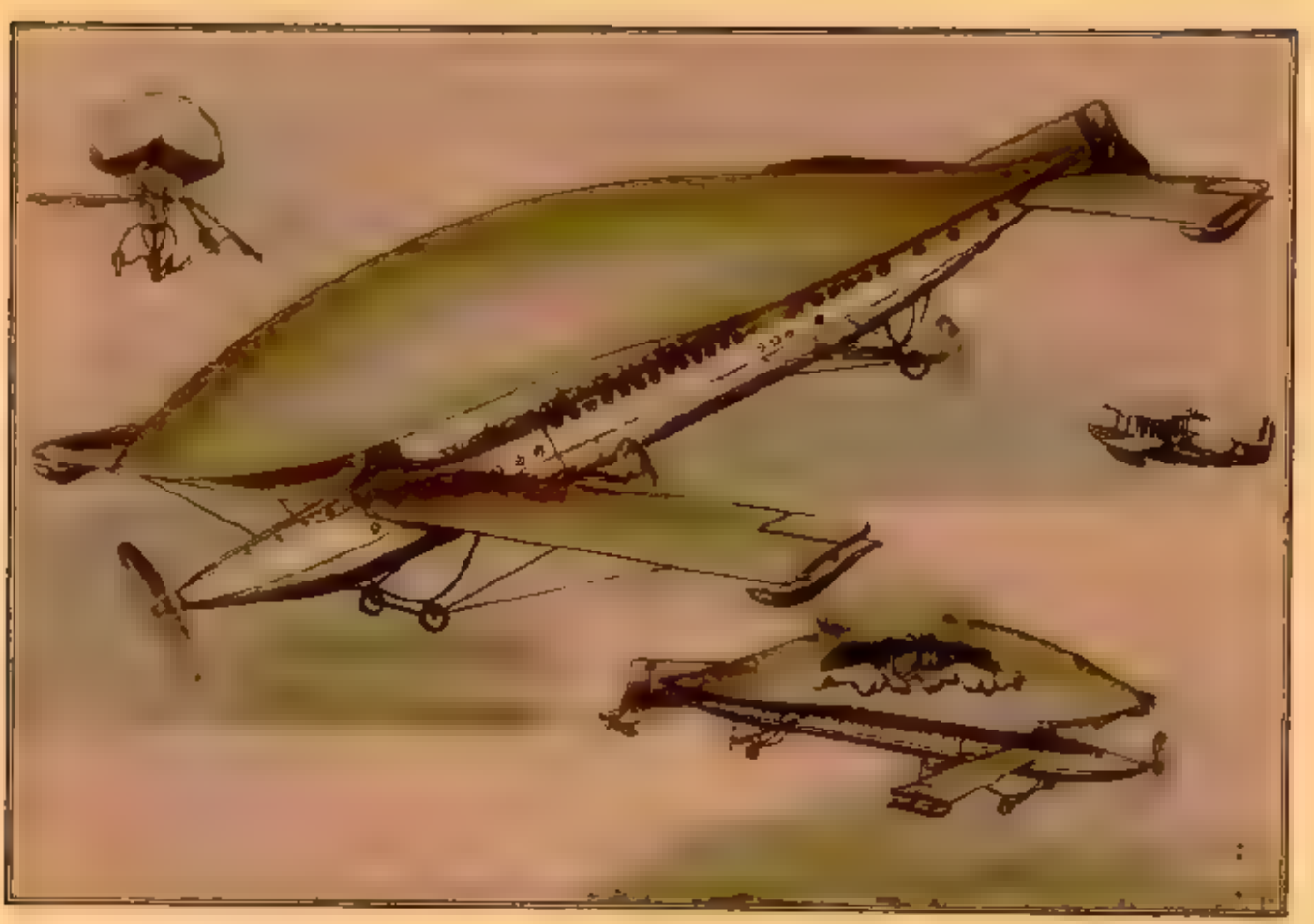

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The air liner shown above is a new type of craft recently patented. It combines the lighter and heavier than air machines, and is so arranged that damage to either the gas bag or the wings will still permit the vessel to continue on its journey without danger to the occupants thereof. Note particularly the streamline design of the gas envelope

# Airplane-Dirigible Can't Fall

## Airliner Arranged to Combine Advantages of Both Types of Craft

ARE we heading toward this type of aircraft? It would seem from the numbers of patents which have been recently taken out on combination lighter and heavier-than-air machines, that eventually slow passenger liners, that is slow in comparison to future speeds, will be hovering everywhere, not only because of their comparative comfort and safety, but also because of their smoothness of operation, their speed, and their general defiance of weather conditions.

Orphee Langevin, a British inventor, has patented the type of aircraft shown in our accompanying illustration. The description which follows will be of great interest to those who look forward to departures from the heavier-than-air and lighter-than-air machines. The device resembles a dirigible having its nacelle equipped as an airplane, thus obtaining a combined dirigible and airplane, having the features and advantages of each, and avoiding any disadvantage attending the use of either alone.

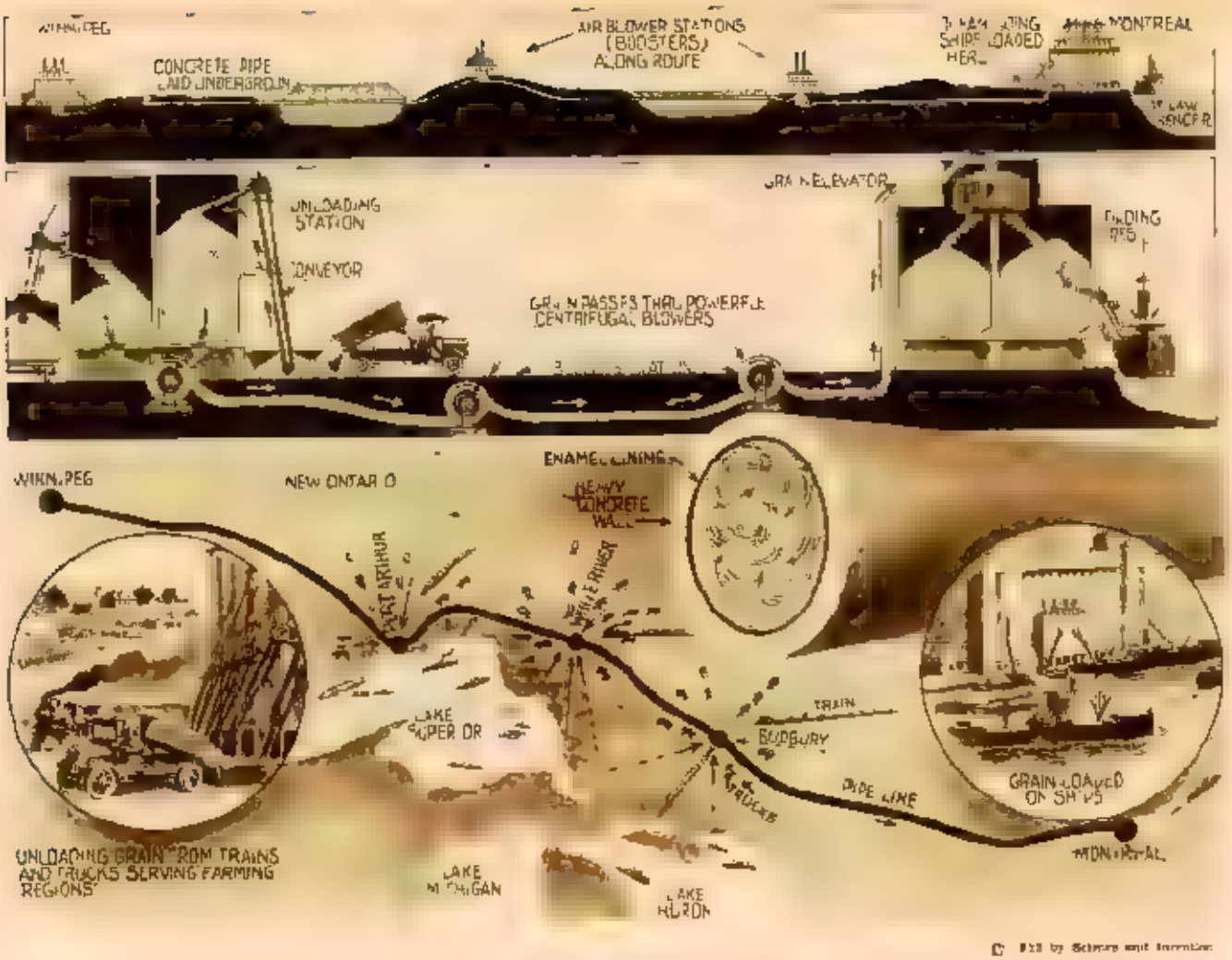
The fuselage of the airplane is the nacelle of the dirigible, as is clearly shown in our illustration. The upper portion of the dirigible itself is substantially semi-circular in cross-section, and its bottom is flattened and cambered to provide a plane that cooperates with the planes of the airplane, to sustain the aircraft while in flight. Although the under surface is flat transversely, it is so curved as to produce convex surfaces at the front and rear ends, with an intermediate concave surface. This peculiar curvature gives a general streamline surface to the gas balloon. Of course, the angle of incidence of the surface must be carefully regulated. The bottom of the gas bag is made of thin aluminum, and the entire body of the plane could be constructed of the same material. At any rate, cross bracings and struts throughout the gas bag are preferably made of this material.

The combined nacelle and fuselage extends for the entire length of the dirigible envelope and is equipped at its forward end with a tractor propeller driven by the usual engines. In addition to that, amidships we find other propellers, each driven by individual engines. In order to permit this craft to descend on land, a framework is arranged at the front and rear end of this nacelle. A pair of wheels are secured to the forward end of this landing gear, and one single wheel is placed at the rear. A pair of pontoons are mounted beneath the front and rear wings at their ends to permit the craft to alight upon or rise from the water.

A decided advantage in this type of craft may be noted in the mounting of the amidship propellers, which can be swung through an angle of 90 degrees from their present or running positions, permitting them to act as helicopters.

The interior of the nacelle is equipped to comfortably carry a relatively large number of passengers in addition to the crew, for whose convenience portholes are found throughout the ship. A companionway, or promenade, protected by a guard rail on either side, permits either passengers or crew to walk from one end of the ship to the other. In event that any part of the gas balloon be ruptured, the ship could still maintain its position in the air and even continue its journey, as it is so designed that the planes themselves could lift the entire weight of the ship, or the dirigible could lift the plane if the wings were broken. There is little danger that both plane and gas balloon would be damaged simultaneously, while the ship is in flight.

As is well known, when a gas balloon reaches the higher air strata, the cold air causes the gas in the balloon to contract, the balloon consequently loses its buoyancy. In order to overcome this objectional feature, heated gases from the exhaust of the motors are delivered to the spaces surrounding the several gas compartments. These pipes are so distributed that the gases will heat to an even temperature the entire contents of the dirigible compartment. The bottom of this dirigible may be ripped open, so that should the machine fall because of insufficient buoyancy and broken wings, it would still act as a parachute, its descent being relatively slow. The details of this ripping arrangement are given in the patent.

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**Some months ago we published an article on a proposed pipe line for transporting coal from the mining regions to New York, and now we have the proposal of a Canadian expert for piping grain to the seaboard, or to be stored, for a distance of some 1,400 miles. The expert in back of this scheme suggests that a pipe line through which the grain will be blown at a velocity of three hundred miles an hour could be built for approximately one-fiftieth the cost of a railroad, and that it could be used to transport wheat, oats, barley, corn or flax. The territory covered is shown in the map. At various points along the pipe line, grain could be brought in from adjacent territory in the manner illustrated, by motor truck railroads, etc.**

# Grain Pipe Line 1,400 Miles Long

## By RAY DYMENT

A PIPE line to blow grain 300 miles an hour for a distance of 1,400 miles has been proposed in Canada to carry grain from Winnipeg to Montreal.

Mr. R. Patrick of Galt, who has made a study of the situation for the past two years, says that such a pipe line could be built for about one-fiftieth the cost of a railroad and could be used to transport wheat, oats, barley, corn or flax.

The pipe line would be heavy concrete smoothly enameled inside, one foot in diameter, laid three to four feet under ground over hill and dale, at river crossings on supports costing less than one-twentieth of a railroad bridge, right of way costing little in comparison, and maintenance of way practically nothing.

A steady stream of air at the rate of 300 miles per hour would be forced through the pipe with a possibility of 400 miles per hour being developed.

At 300 miles per hour the grain would travel five miles per minute or 26,400 feet. The grain is fed into the pipe at the rate of one pound to every foot of that rushing tornado, or say not over a few grains to each of the 1,728 cubic inches in that foot. Wind at 100 miles per hour will carry sand particles weighing less than one-twentieth of a grain of wheat—the heaviest of grain.

What will stop wheat in a 300 mile blast? It means that the minute you start feeding in the grain at Winnipeg in a little over four hours it will start discharging in Montreal 26,400 lbs. of wheat per minute, 26,400 bushels per hour or 633,600 bushels per day.

It is well known that a pea may be shot almost clear across the street with a puff of the breath, while it has no resistance to overcome the minute it leaves the tube, whereas the grain in this pipe would have no atmosphere to overcome.

# Reducing Hematite To Magnetite With Methane

During recent experiments on the reduction of iron ores with the gases carried out at the Pacific Experiment Station of the Bureau of Mines, Berkeley, Cal., it was noted that at temperatures up to 800° C. (1472° F.) the methane in these gases was practically inert as compared with hydrogen or carbon monoxide. A number of experiments were then carried out with mixtures of methane and hydrogen over a wide range of temperatures to find out when the methane would begin to function actively as a reducing agent. While it reacted slowly at all temperatures tested, its reaction in the reduction of hematite to magnetite, the first stage in the reduction of iron, did not become sufficiently rapid to be of industrial importance until temperatures of over 900° C. (1652° F.) were used. A rough approximation of the velocity constant of this reaction was made for all the temperatures at which tests were made in order to obtain some useful figures of value in designing industrial apparatus for carrying out this reaction. The details of these experiments are contained in Serial 2382, which can be obtained from the Bureau of Mines, Washington, D. C.

# X-Rays and Electric Current To Kill Cotton Weevil

THE cotton growers of the Southern States are up in arms, and ready to spend valuable time and money in an effort to annihilate the ravages of the devastating boll weevil, sometimes called *cotton weevil*, which according to an estimate made by Dr. L. O. Howard, Chief of the Government Bureau of Entomology, caused a crop loss in five years of more than one billion, six hundred million dollars. A number of different inventions have been patented and devised for the purpose of killing the boll weevil, but so far there does not seem to be any effectual method of overcoming this pest. Two methods of killing the boll weevil recently suggested by Dr. Miller Reese Hutchison, formerly chief electrical engineer to Thomas A. Edison, are illustrated and described herewith.

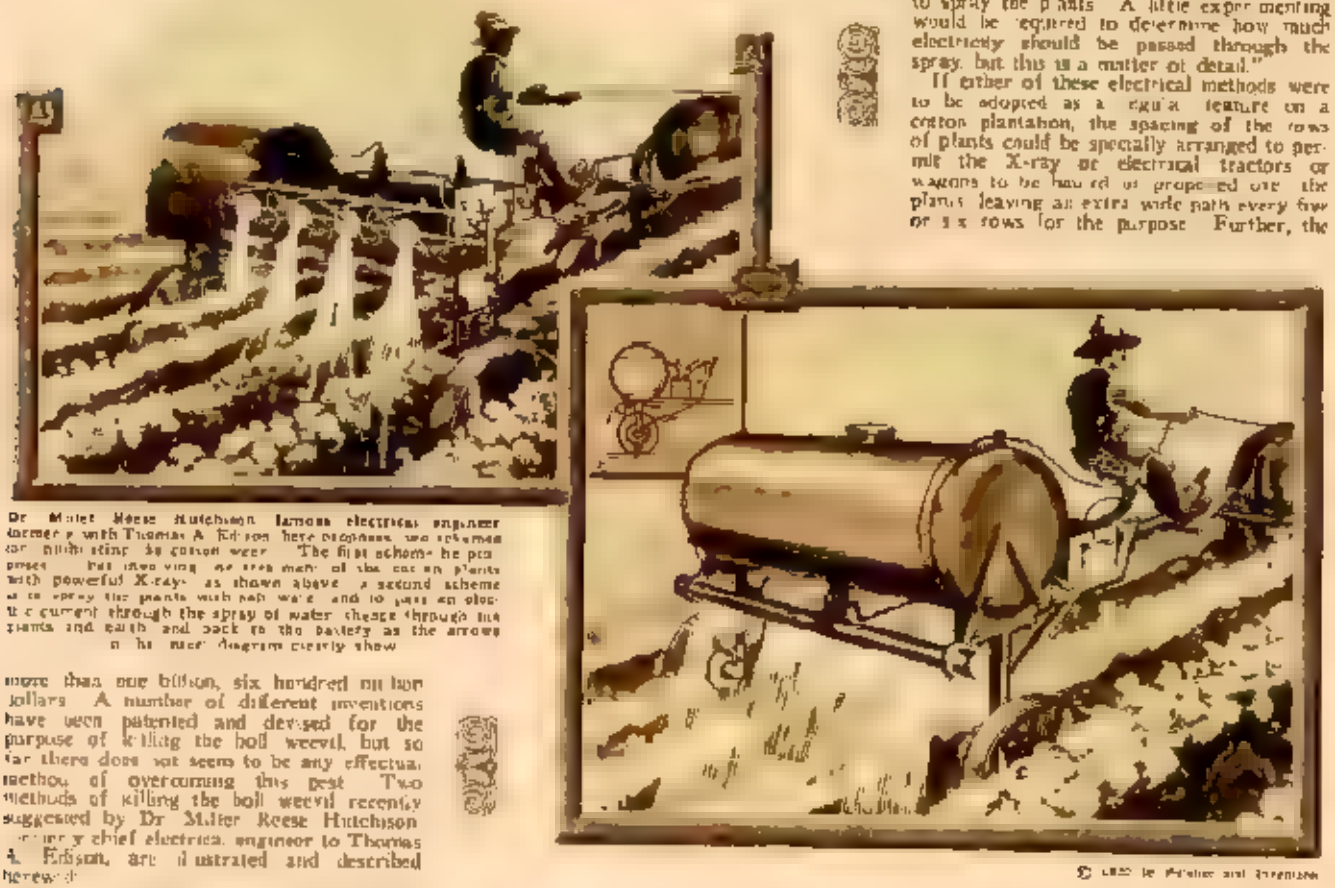
Of Dr. Hutchison's suggestions one is the treatment of cotton plants with powerful X-rays by drawing a cart or wagon over several rows of the plants simultaneously, this wagon being fitted with X-ray tubes and the necessary high voltage exciting apparatus, as shown in one of the pictures. The second suggestion here illustrated is to passing a low voltage electrical current from a storage battery or dynamo through the plants, via streams of dilute salt water, sprayed over them from a suitable wagon or tractor, as the other picture shows. Regarding these two methods, Dr. Hutchison stated:

It is known that sterility can be induced in the male and female of the entire animal kingdom and in all kinds of eggs by the intelligent and local application of X-rays. The boll and in fact all parts of the cotton plants, are transparent to X-rays. Therefore, why could not the eggs laid by the moth and the weevil hatched from the egg be made sterile by the application of X-rays from a battery of tubes mounted on a high wheeled vehicle straddling several rows of plants, and drawn along by a properly constructed and equipped vehicle?

Heavy sheets of lead properly bent and placed over the tubes would shield the operator, concentrating the X-rays down and protecting sterility in every egg and weevil on the plants.

Some genius has discovered that adult weevils are killed by an electrical current having a potential of six volts. If such is the case it would be a very simple matter to spray the plants. A little experimenting would be required to determine how much electricity should be passed through the spray, but this is a matter of detail."

If either of these electrical methods were to be adopted as a regular feature on a cotton plantation, the spacing of the rows of plants could be specially arranged to permit the X-ray or electrical tractors or wagons to be hauled or propelled over the plants, leaving an extra wide path every few or six rows for the purpose. Further, the current for propelling the specially built tractor equipped with extra large wheels could be taken from overhead trolley wires and poles similar to those used for trolley cars. On some of the German electrified farms tractors and other farm machines are propelled over the fields in this way.



Dr. Miller Reese Hutchison, famous electrical engineer formerly with Thomas A. Edison, here proposes two schemes for exterminating the cotton weevil. The first scheme he proposes is that involving the treatment of the cotton plants with powerful X-rays, as shown above. A second scheme is to spray the plants with salt water and to pass an electric current through the spray of water, thence through the plants and earth and back to the battery, as the arrows in the lower diagram clearly show.

© 1922 by Patterson and Sampson

# Oyster Changes Its Sex Three Times

Although an oyster's existence is usually a shut-in one, yet there is one oyster hailing from the River Blackwater, near Colchester, England, who has seen much of life.

He has changed his sex three times in the past twelve months.

This fact is vouched for by Dr. J. H. Orton, a well known scientist of West Mersea. He found a male oyster in June, 1921, and kept it even going so far as to give it the pet name of Oliver, he is, of course, unaware of the curious feast in the creature's nature.

Young Oliver, according to a letter written by Dr. Orton to the British Medical Journal, was a happy, contented, affectionate little bivalve until July 3, 1922. On that day Dr. Orton found that Oliver had presented him with thousands of young oyster children.

Oliver's name was immediately changed to Olivette, but a fortnight later it was found that he or she had again joined the male sex. So that within twelve months Oliver or Olivette, according as he or she may be today, has had three experiences of sex.

Oliver is now taking a vacation in the Marine Biological Laboratory at Plymouth, where members of scientific men sit at his feet and in order to avoid confusion he is now commonly addressed as "Olly."

Dr. Orton thinks that the sex change is due to changes in the environment and the question Olly can please himself whether he will be a male or a female. He hopes to learn a lot more yet about the oyster.

But Olly sits tight and says nothing.

Wherefore all the investigations and scientific researches by men of worldly fame who attempt by means of X-rays, diet, freezing, and other natural and unnatural means to change the sex. As a matter of fact a German scientist has recently produced hundreds of hermaphrodite guinea pigs, but here is an oyster who actually changes his or her sex at will. If an oyster may be said to have a will, or as previously mentioned when given a nice warm bath becomes male or female, dependent upon temperatures, etc.

# Future Wars and the Long Range Gun

By NOEL DEISCH

AMONG all the murderous contrivances that were newly born or developed during the European war none caused more appalling possibilities of desolation than the super cannon or long-range gun. We refer of course to the Big Bertha. Before the war had ended the world knew St. Gothard and other deep bronze tubes that shot projectiles of more than two tons weight for 80 miles, dropped down on Paris with deadly accuracy and destroyed many a church and home and public building, converting them into heaps of ruins.

The "Big Bertha" was an unprecedented and a sensational contraption, but no one has ever doubted that its materiality as an accountable weapon for evil had been exaggerated by the horrible stories of its ghastly effect. Over against every picture representing the precipitation of gun ordnance we can not help setting one of its crew, a picture which we know many of which were not genuine.

Not many people are worrying about long-range guns nowadays, nor is it probable that they ever shall, for the one again comes or three or four men up to be annihilated by them. Nevertheless a few of us feel a little [illegible] and shall ever or as a little [illegible] up-to-the-minute we want to know what we may expect our experts at the War Department to produce.

Everybody knows that the natural path of a stone thrown by the hand will go but not everybody knows that under conditions it will go more than twice as far when thrown with twice the speed, or, to put it in other words, the range increases more rapidly than the velocity in vacuum and at a definite range of elevations. This fact is more strikingly true of the long-range projectiles, and as we shall see, approximately when the velocities become of the order of those produced by a supercannon.

Take a cannon which shoots a projectile with a velocity of 2,000 feet per second. It would shoot 24 miles in a vacuum, conditions were mathematically ideal. But a gun having a velocity of 4,000 feet per second, just twice as great, would reach not twice or nearly 4 times as far. If the velocity of the projectile is pushed much beyond this figure we will get a rather surprising result. Only 1,000 feet per second added to our previous 4,000 feet, that is, 5,000 feet or nearly a mile more a second, will make the projectile go 47 miles. Not to become tedious it may be stated that it can be proved mathematically that a projectile with a velocity of 25,000 feet per second, or a little more than five miles, would go all the way around the earth. It would travel above the atmosphere and therefore, if aimed correctly, it could be made to fall on any part of the earth that might be desired. In fact, if the shell were projected at a velocity of seven miles per second it could be made to go as far as the moon, or to any other body out in the sky. It never came back at all, but that is another story. We are interested just now in projectiles that do come back and in the fact that in theory we can have a gun that would discharge them with a velocity only a little over six times greater than that which has already been attained by artillerists, would be in a position to drop a shell on any part of the earth's globe or [illegible] it might be his good pleasure to choose.

There are of course very considerable difficulties in the way of constructing a gun of the kind from an engineer's working drawings, which rest on a basis of pure theory to a practical structure of steel, resting on a basis of reinforced concrete. Yet these difficulties have not appeared in any way insurmountable to some artillerists, to Major J. Mackrow-Addison, for instance, who wrote a long article in the *Journal of the Royal Artillery* published during the war, spoke very hopefully of the future of the Big Bertha.

(Continued on page 894)

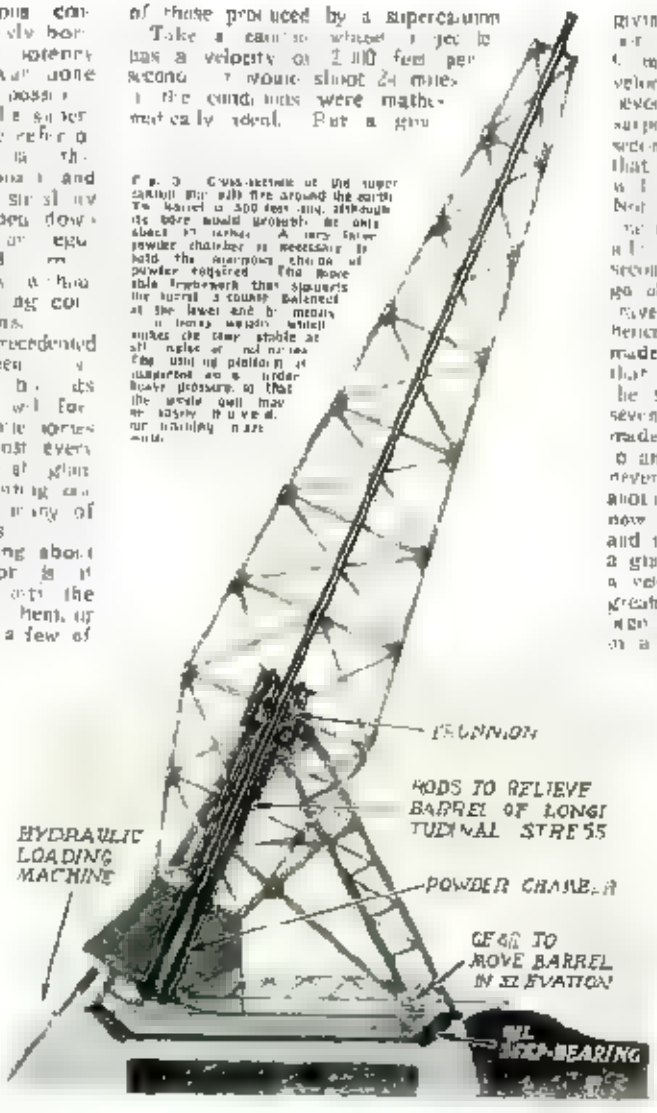



Fig. 3. Cross-section of the super cannon that will fire around the earth. The barrel is 500 feet long, although its bore would probably be only about 87 inches. A very large powder chamber is necessary to hold the enormous charge of powder required. The movable framework that supports the barrel is counterbalanced at the lower end by means of heavy weights, which makes the gun stable at all angles of elevation. The gun will be pointed by means of hydraulic pressure, so that the whole shell may be easily moved, or manipulated, in any direction.

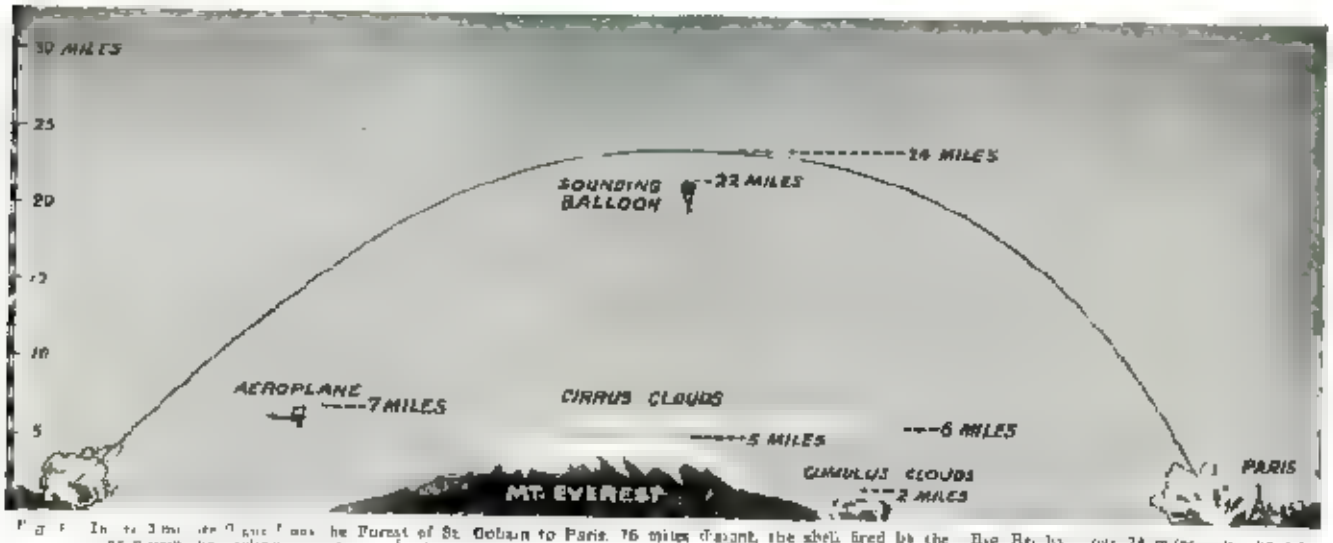
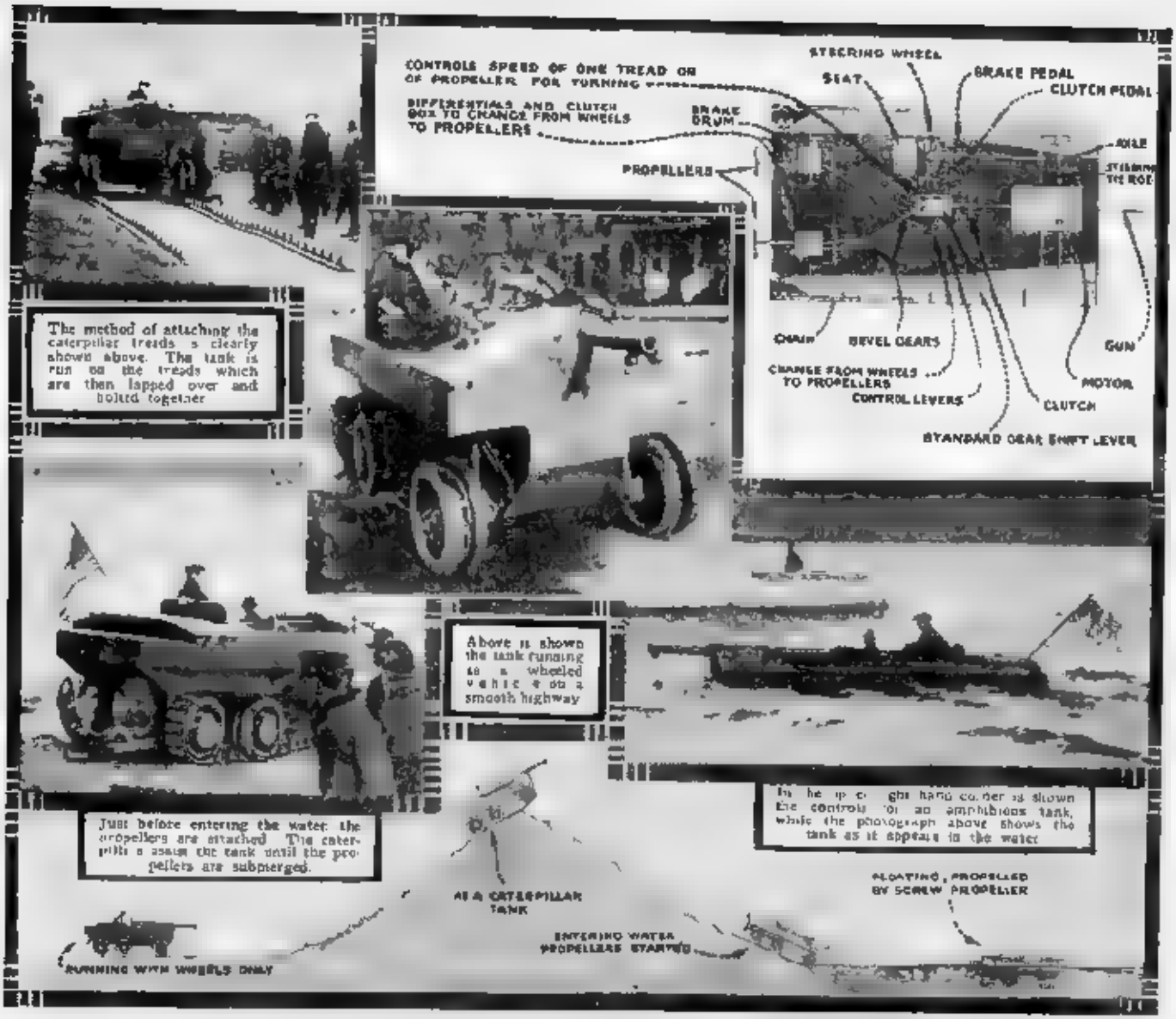



Fig. 4. In this diagram the Forest of St. Gobain to Paris, 76 miles distant, the shell fired by the Big Bertha will rise 24 miles, to be far above the highest mountains, the highest clouds, and the highest flights made by aeroplanes or balloons, whether manned or not.




# An Amphibious Battle Tank

By A. P. PECK

An extraordinary battle tank was recently demonstrated before representatives of the War and Navy Departments of the United States, and several hundred members of the American Society of Mechanical Engineers in New York City and directly across the Hudson thereafter.

This new tank which is the invention of Walter Christie is so designed that it can be used either as a wheel or caterpillar tank, or as a boat. It can navigate any ordinary stream, river, or inland lake with perfect safety and comfort to its occupants. Mr. Christie is President of the United States Mobile Ordnance Company, and has several other inventions and improvements on tanks to his credit.

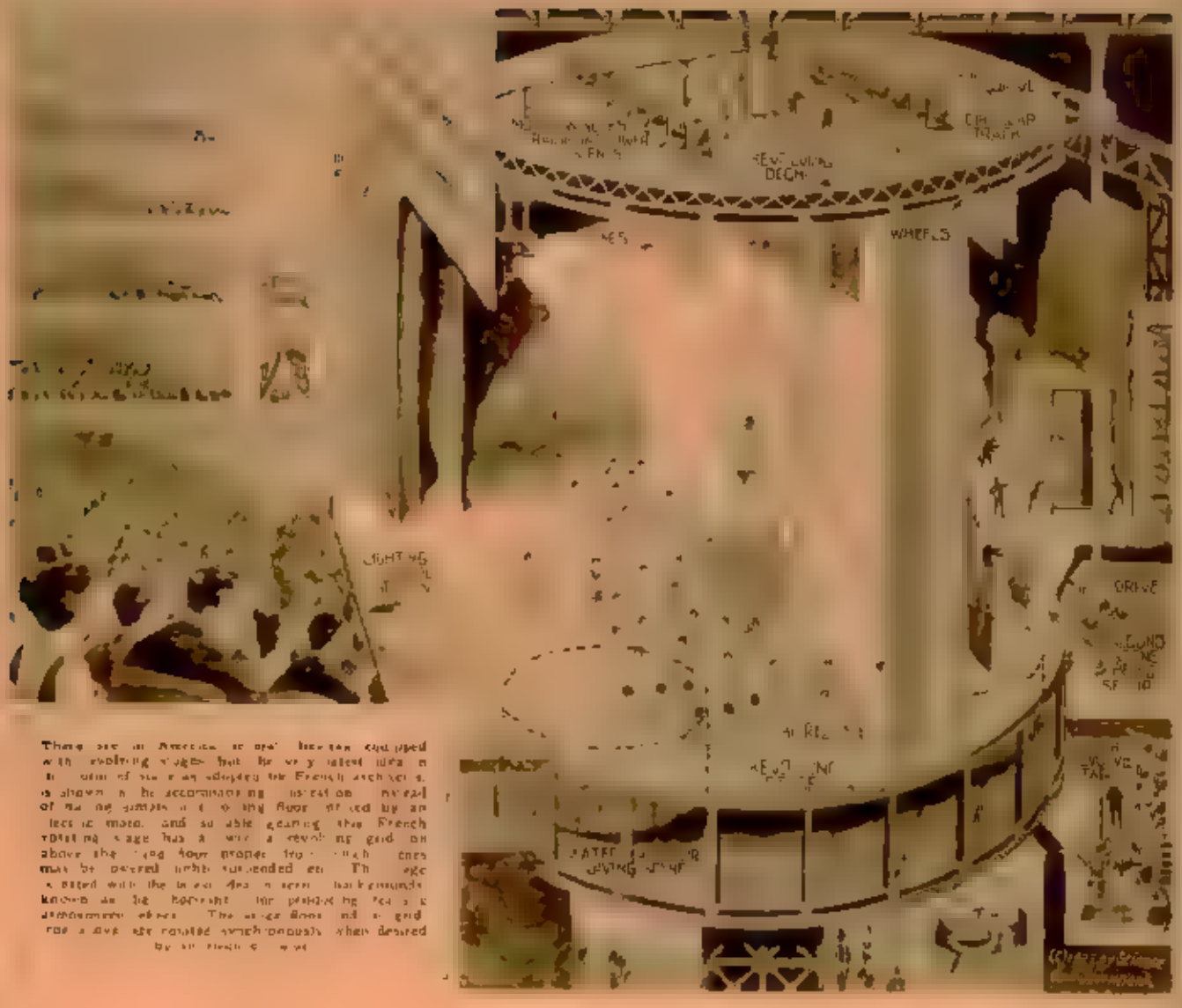
The tank itself, which is shown in the accompanying photographs, is a formidable looking affair mounting a 3-inch gun on its forward end. Six wheels carry the steering mechanism, the two rear pairs of wheels being connected together by means of sprockets and chains, as shown. A steering wheel is arranged to accommodate the front wheels when it is desired to drive the machine as a wheel tank. When being driven in this way it is capable of making twenty-five miles an hour on a smooth road. The wheels are equipped with heavy rubber tires, so that the machine may be used on city pavements without doing the damage that the ordinary tank may do.

When rough going is encountered, the wheels are equipped with caterpillar treads, the actual attaching being done as shown in one of the accompanying photographs. The caterpillar tread, which is arranged in a long strip with spikes on the inner surface, is laid out on the roadway in two parallel lines. The tank is then run over these strips, so that the spikes engage in slots cut in the center of the periphery of the wheels. The strips are then brought over the tops of the wheels and bolted together, whereupon the machine is ready to travel the roughest of terrane. This change can be done by trained men in the space of a very few minutes.

When the tractor is being run in this way the steering is done by means of variable gears, which drive one side either faster or slower than the other, thereby, of course, causing the tank to turn. The transmission boxes for this work and the lever for controlling a tractor of this type are shown in the accompanying illustration. These transmissions are also used when it is desired to propel the vehicle through the water.

When on demonstration, the tank left the Engineers' Building in New York City, and traveled under its own power up Riverside Drive. It was transported to the Jersey shore on a ferry boat, where it was put through its paces on land. Here the caterpillar treads were attached and the tank started up a steep incline. As it struck a forty per cent. slope the treads slipped and spun for a second in the soft mud, and for the instant it looked as if the tank were going to topple over backwards into the river. The field gun on the forward end pointed almost directly to the zenith, and the machine veered dangerously. In a moment, however, it regained its equilibrium, and started up the steep grade with the same alacrity that it displayed on the level. The occupants of the tank, however, had some trouble in keeping their seats, and it was necessary to hang on tightly in order to keep their places, and prevent themselves from falling out backward. The machine climbed for a distance

(Continued on page 1029)




There are in America several theatres equipped with revolving stages, but the very latest idea in the form of stage adopted by French architects, is shown in the accompanying illustration, instead of the stage consisting of a revolving floor actuated by an electric motor, and suitable gearing, the French revolving stage has a wide revolving grid-iron above the stage, from which scenes may be lowered while suspended on. The stage is fitted with the latest devices in scenic backgrounds known as the Horizont for producing realistic atmospheric effects. The stage floor and grid-iron revolve over the rotating switch previously, when desired by an electric current.

# Novel French Revolving Stage

REVOLVING theatre stages are not new to American theatre-goers as they have been known and used here for many years, but one of the most unique is that here illustrated, and which is used in several French theatres. One of the leading New York playhouses—the *Century*—has a large revolving stage on which two or more scenes may be set simultaneously, to be brought into view one after another for the different scenes or acts. But the scenes hung from the fly gallery do not rotate with the turn-table stage, as they do on the French stage here illustrated.

To avoid building a cumbersome and awkward rotating structure seventy feet high or more, in order to turn the fly gallery or grid-iron, as it is usually called in theatre parlance, an ingenious scheme of revolving the circular stage floor and the grid-iron synchronously was evolved by the French architects and engineers. As shown in the picture a vertical shaft at one side of the stage and of sufficient strength is arranged so as to turn both the stage and the grid-iron above the stage, by means of two sprockets and large chains, the shaft itself being driven by another sprocket and chain, or else by gears in some cases, which connect with a suitable electric motor. When the signal is given the stage electrician operates the proper switches, and the stage and its grid-iron rotate in step with one another. Drop cloths, scene drops, *et cetera*, are suspended from the grid-iron and these are raised and lowered as desired, by a series of electric winches, as shown in the illustration. This grid-iron is a very substantial affair and rotates on a series of rollers or wheels, arranged around its periphery which bear on a circular track supported by suitable girders. The center of the rotatable grid-iron is arranged on an extra large pivot suitably braced and supported. Electric current is supplied to the grid-iron for the motor winches used in raising and lowering scenes, lights, etc., by means of flexible cables, or else through a commutator ring and brush arrangement.

This revolving stage does not consist merely of a floor which can be revolved as desired, by simply pressing an electric button, but it consists of a double floor arrangement with quite a space in between the floors suitable for accommodating framework for various water tanks, etc., which may be necessary in certain scenes, for example where people dive into the water. This revolving stage is fitted with two or rather a double type *Horizont* which is coming into popular use nowadays, as it gives very pleasing sky scenes, the sides and top of the horizon being curved, so as to give a natural sky effect. These horizons are usually made of plaster on a wire lath or equivalent frame or reinforcement. At the front of the stage a series of electric control buttons are situated, so that the revolving sections can be actuated if desired from this location. The stage manager is located in a small compartment, the top of which is almost flush with the stage, the rear side of this compartment being open, so that he can see the actors and the scenery readily.

Telephone communication is provided between the stage attaches on the revolving grid-iron and the stage manager, below so that orders can be given for changes in scenery, etc.

March

# Science and Invention

## THE SLEEP ELIMINATOR

See Page 1062

The Sleep Eliminator as visualized by our newspaper artist. Mr. Gernsback, in his article, suggests in order to eliminate sleep, to remove the cause. The cause of sleep is increased blood pressure and certain changes in nerve cells after the body has performed a certain amount of work during the day. These changes are regulated by electric currents, which are set up in a human body by simply walking in the office as seen. These currents, as is well known, reduce the blood pressure. The oxygen in which the blood gets a small quantities helps to rejuvenate the system. A secondary electrical system gives the nerve cells rhythmic shocks, almost imperceptible to the subject. These are used to stimulate the nerve cells that have become sluggish. It is thought that by these means sleep can and will be eliminated entirely.

# The Sleep Eliminator

By H. GERNSBACK

*Member American Physical Society*

**COMING INVENTIONS NO 8**

ONE of the most ancient and universally known phase, not only of human existence but of almost the entire animal world, is *sleep*.

It is such a habit with us that we never give it the slightest thought, and we do not bother our heads much about it, unless we suffer from insomnia or if important work keeps us up perforce, when we are trying to fight off sleep.

But what is sleep itself? No one knows exactly. There are many theories of sleep today the best known being the following: the Chemical, the Circulatory and the Histological.

The *Chemical* theory mainly has to do with auto-intoxication. This theory is based upon the fact that certain products of decomposition of living substances influence the continuance of cell activity, but recent researches in the bacteriological laboratory have proved that while the body is working during the day's activities certain poisonous are formed in the human system more rapidly than they can be oxidized and eliminated. It is maintained that while we sleep, such poisons gradually become oxidized and are thus removed from the blood.

The *Circulatory* theory has to do with congestion of the blood vessels. It is a theory no longer accepted by scientists.

The *Histological* theory has to do with the nature of the nerve cell because microscopic examination has shown conclusively that such nerve cells have different chemical properties when the body is in a waking or in a sleeping or fatigued condition.

Other outstanding phenomena, characteristic of actual sleep are full relaxation of nearly all the muscles of the body, slow and rhythmic, as well as deep breathing, a slow and weak pulse, and considerably lessened arterial pressure.

But is sleep really necessary and could man or animal do without it? The answer must be in the affirmative once we discover just the exact reasons why sleep takes place.

We find, for instance, that protozoa and other simple forms of life seem to dispense with sleep, without any trouble. Many fish, for instance, do not sleep, and while their activities may not be the same at all times they do not seem to know what sleep, as we know it, really is.

In other words, sleep is a habit formed by human beings, mainly due to astronomical reasons. If the sun had been shining upon the earth constantly we probably would not know now what sleep is. For one part of the day we have light, for the other part, darkness. After sundown it is no longer possible to see, and the caveman and our other ancestors simply lay down and formed the habit of sleeping until the sun came up again. That this is a true statement is best proved by the fact that as soon as artificial lighting appeared, the human race no longer needed as much sleep as did our cave ancestors. Even as recently as 500 years ago people went to sleep at sundown and got up when the sun rose. That means an average of ten to twelve hours sleep. The modern human being gets along comfortably with from six to eight hours, as his artificial light keeps him awake, and the less he works physically the less sleep he needs.

Naturally this statement does not hold true of a laborer or a man who performs great physical exertions during the waking hours. Such a man becomes really fatigued and his blood pressure during the night time must be brought to normal, and his nerve cells must be regenerated once more.

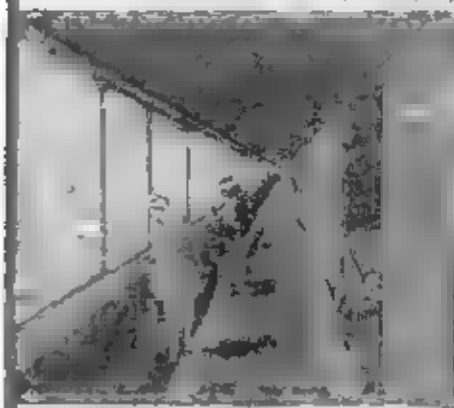
But we are safe in saying that if the human race continues as it does now with artificial light during the entire night, a time will come in 10,000 or perhaps 50,000 years, when sleep will be required no longer.

Edison, a few years ago, made some very striking observations when it was necessary to work literally day and night in his laboratory. He selected a number of young men

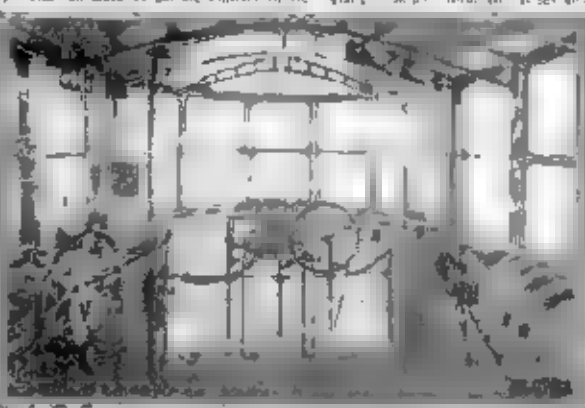
(*Continued on page* 1114)

# BERLIN - NEW YORK - CHICAGO
## VIA THE AIR

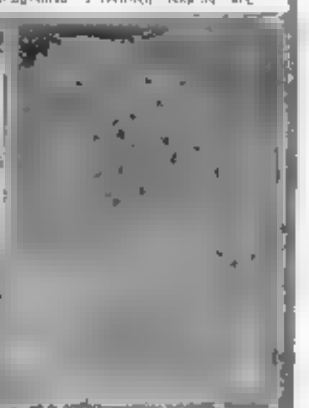
The magnificent [illegible] gives the passengers compartments along the promenade deck of the new giant dirigibles being built for the Berlin-New York-Chicago air traffic. Note how comfortable the passengers will be while floating through the air at an altitude of several thousand feet. Miss [illegible] of course, be served at cruise and as the other pictures on this page show the passenger cabins are all arranged for convenience along the [illegible] of the ship. One can sleep as well as in a compartment on the giant ship. Here the passengers are provided with [illegible]



View along the aluminum deck of the huge [illegible] Atlantic dirigible. These [illegible] are lighted by electricity. And glass panels in the [illegible] will permit the passenger to look directly downward.



View showing the interior of the control cabin, the [illegible] and vertical rudders being operated by cranks and the wheels shown, while the handles at the right control the various engines driving the propellers. The [illegible] of the cabin will be noted, being made of glass all the way [illegible]



The Schutte-Lanz airship in the course of construction at German factories [illegible] less the external skin.

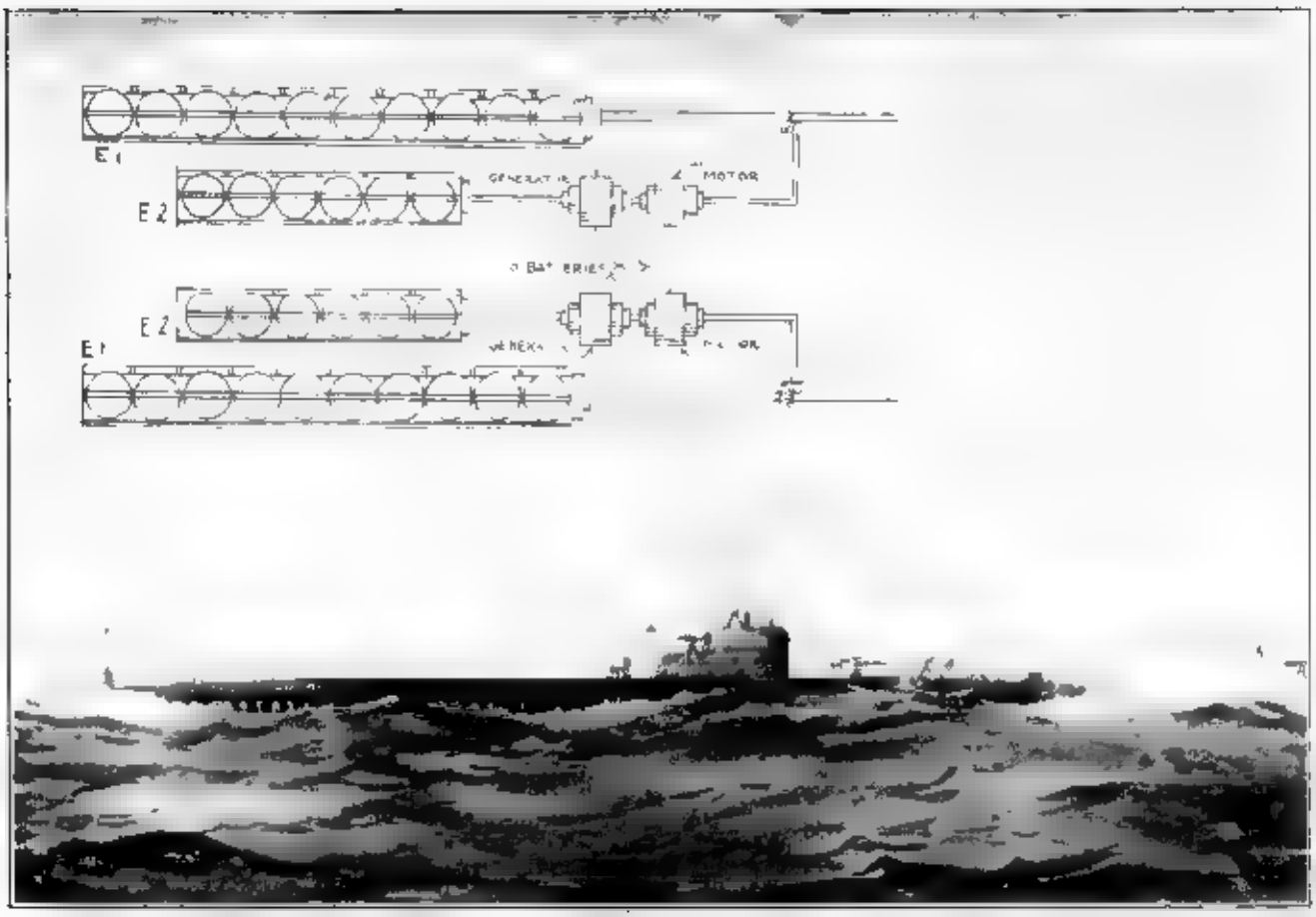
The photo shows the [illegible] and [illegible] engines and propellers [illegible] arrangement.

View looking aft in the cabin [illegible] with [illegible] and water ballast [illegible]

# Recovering Sunken Treasures

A NEW device for salvaging sunken ships and [illegible] the latest [illegible] Tests [illegible] by Dr. C. W. [illegible] (although the trials have not been completed) worked [illegible] as the [illegible] offer [illegible] guarantee [illegible] the vessel [illegible] and [illegible] ship [illegible] The salvaging [illegible] are [illegible] sunken. To overcome one of the difficulties [illegible] our present salvaging schemes, [illegible] are designed [illegible] from the [illegible] either [illegible] spherical portions

These are connected together by means of a bridle-like structure. A rope runner [illegible] fastened to the [illegible] mechanism for [illegible] fatigue and [illegible] [illegible] cause them to rise or submerge as desired by the [illegible] The whole structure is completely enclosed [illegible] and [illegible] necessary [illegible] [illegible] [illegible]




Our new submarines of the V type, which have just been laid down at the Portsmouth Navy Yard. The upper shows the engines which are of the M A N. Diesel type. Those marked "E" are the main drive engines which operate on the shafts at the end of which are the screws which drive the vessel. Those marked E2 are engines of the same type of which but half the power. They are used to drive the generators which in turn charge the vessel's storage batteries for submerged cruising. The motors which run off of the generators take their power from the batteries when cruising submerged. In the event it is desirable to use the full power of all the engines on the surface such as would be the case in fleeing from a more powerful vessel, the E2 motors can also turn over to the main drive engines of the following manner. The generators are cut off from the batteries and connected directly with the motors which in effect gives the same electric drive system as used on our larger battleships. Thus all engines are connected with the main drive shafts, giving the maximum power at the time it is needed. This mechanical feature makes these V boats the forerunners of the super submarines of the future.

# The Submarine of Tomorrow

## By GRASER SCHORNSTHEIMER, Naval Expert

STRANGE as it may seem, the all important submarines were not revealed in the late war. As a commerce destroyer and raider its use was fully demonstrated, but its [illegible] as a fighting machine was little required. The submarine of the future must be capable of all these duties, though each vessel of the future type will probably be designed for specifically one duty or another.

The greatest submarine in service today is the French "Hauterive" formerly the German "U-139". She is really a large vessel of 1930 tons surface displacement and 2480 tons submerged. She is considered an ocean going cruiser. In design she is a forerunner of the great boats which will attempt to control the seas in time of war, twenty-five years hence.

She has a complete double hull, which is well subdivided into many compartments. She is fitted like a battleship with anti-rolling tanks. Her engines are the ultra-modern 6 cylinder, 4 cycle Diesel motors of the M A N type. There are two in number and develop 3500 horse power to give the vessel a speed of 17.5 knots on the surface. Having been designed for ocean cruising as a commerce destroyer its endurance is very high—18,000 miles at a speed of 8 knots.

Its submerged motive power is derived from electric motors operated by great storage batteries, which are charged by generators operated by the Diesel engines when the vessel is cruising on the surface.

American submarines have not been so successful as those of foreign makes. The principal reason has been the inability of the engine builders to produce a Diesel motor practicable for the submarine.

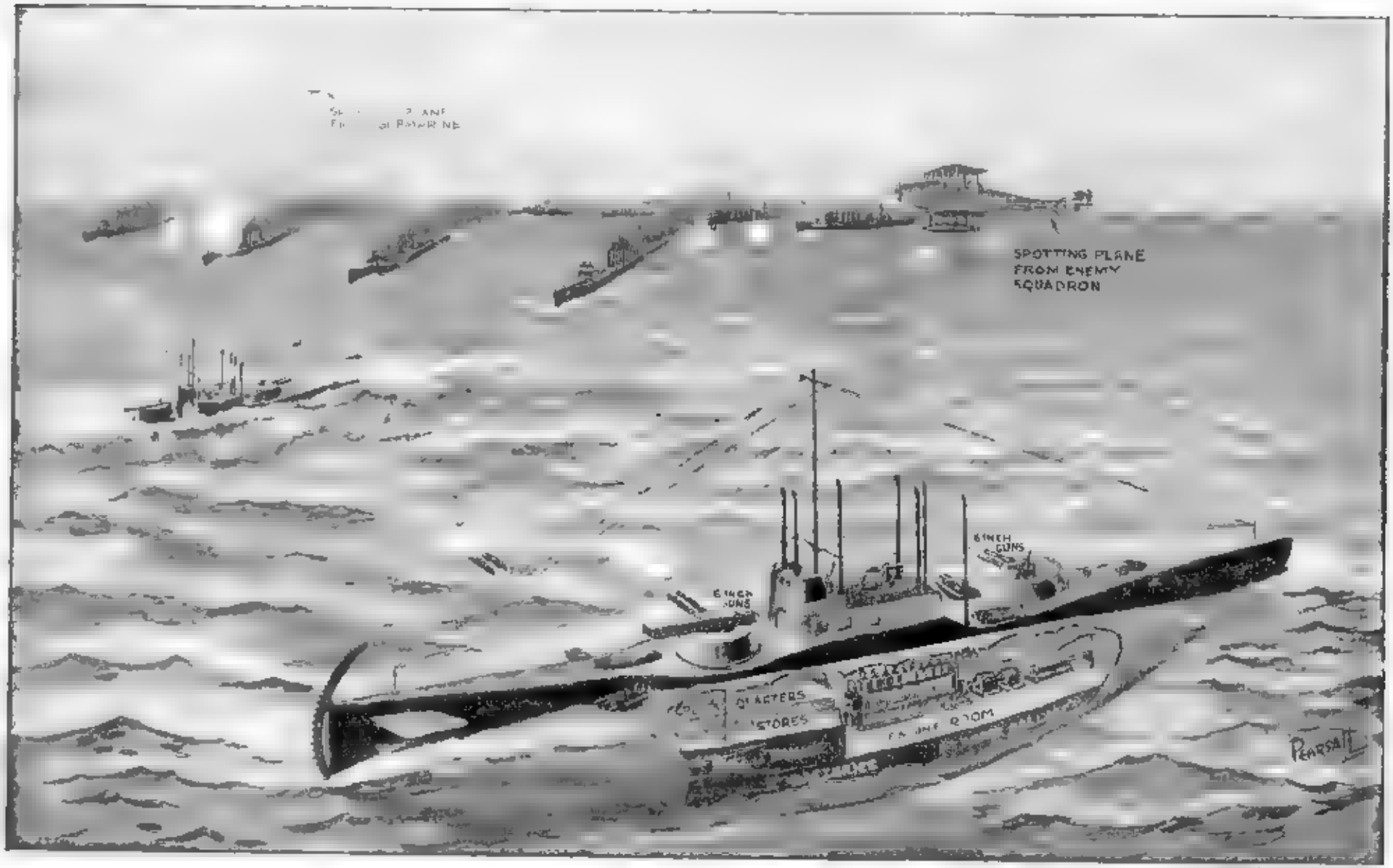
But our engineering difficulties, which seem to be purely those of design are now over as the Navy Department is undertaking the manufacture of proper engines in Government shops. German submarines and the latest types of the best German Navy Diesels were brought to this country shortly after the war. These engines, the famous M.A.N. or German Navy type were carefully measured and new ones were built at the Brooklyn Navy Yard. They are wonders of perfection which seem to have overcome the defects of other types. For horse power they are lighter and more efficient than any engine we have ever had heretofore. Several submarines of the "S" type have been re-designed with these Diesels and they have unsatisfactorily bettered their past performances, though before this change, the "S" class had proved itself to be the finest in our submarine service.

Last year the Navy Department received the extra appropriations to cover the construction of three of the new "fleet" type submarines authorized in 1916. With these new boats it will be possible to start anew our submarine history with real vessels built by Navy engineers, on Navy designs and in Navy yards. They were assigned to the Portsmouth Navy Yard for construction and their engines will be built at the Brooklyn Navy Yard. A most advanced design has been given them.

These boats are known as the "V" class. They will be about 335 feet long, have a beam or area of 47 feet and draw about 16 feet of water when on the surface. The normal surface displacement will be 2,035 tons and submerged 2,506 tons are reported as around 2,500 tons. The engines will be two 2400 horse power M A N Diesel motors operating on the main drive shafts. There will be two auxiliary 850 horse power engines to drive the electric generators which charge the storage batteries for submerged cruising, *and it is the hoped regarding the practicability of the electric drive or increasing the speed of submarines these electric generators can be run from one or more engines connected with the main drive shaft and can be used for surface cruising.* All the naval constructors will say regarding these boats is that they are expected to have speeds of about 21 to 23 knots but as orders are well performed, expect that these Diesel engined American submarines will equal the speeds of the British steam driven "K" boats—of 24 knots.

The cruising radius of these "V" boats will be very large, permitting them to operate with the battle fleet on all occasions. It is

(*Continued on page 1100*)




## THE SUPER-SUBMARINE OF TOMORROW

The super-submarine of the future in action. The vessel in the foreground is one of the second division, which has been badly [illegible] by the eight destroyers [illegible] the attacking force. The division of destroyers is preparing to ram the submarine making a crash dive. The second division will [illegible] to the left and [illegible] the submarine [illegible] for a dive. The [illegible] will be unable to [illegible] the vessel. The [illegible] and the [illegible] within range compartment [illegible] greater speed than the destroyers [illegible] the [illegible] Two vessels in the foreground [illegible] a deep spread of twenty-four [illegible] the whole [illegible] the size of the one shown here [illegible] possible to stow a [illegible] airplane [illegible] be [illegible] as [illegible] and [illegible] a spotter [illegible] the [illegible] No other [illegible] plane can be [illegible] a spotting machine on the sea [illegible] The [illegible] guns are used to drive off enemy planes [illegible] spot the enemy's [illegible] Note the number of periscopes [illegible] the [illegible] vessel [illegible] days to [illegible] [illegible] [illegible]

# The Star

**By H. G. WELLS**

It was on the first day of the new year that the announcement was made, almost simultaneously from three observatories, that the motion of the planet Neptune, the outermost of all the planets that wheeled about the sun, had become erratic. Ogilvy had already called attention to a suspected retardation in its velocity in December. Such a piece of news was scarcely calculated to interest a world the greater portion of whose inhabitants were unaware of the existence of the planet Neptune, nor outside the astronomical profession did the subsequent discovery of a faint remote speck of light in the region of the perturbed planet cause any great excitement.

Scientific people, however, found the m-

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Above were the lava, hot gases, and ash, and below the seething floods, and the whole earth swayed and rumbled with the earthquakes. Soon the commercial rivers of Tibet and the Himalayas were melting and pouring down by ten million deepening converging channels upon the plains of Burma and Hindustan. The angled summits of the Indian jungles were aflame in a thousand places, and below the hurrying waters around the ruins were dark objects that struggled feebly and reflected the blood red tongues of fire.

telligence remarkable enough even before it became known that the new body was rapidly growing larger and brighter, that its motion was quite different from the orderly progress of the planets and that the deflection of Neptune and its satellite was becoming now of an unprecedented kind.

Few people without a training in science can realize the huge solution of the solar system. The sun with its specks of planets, its dust of planetoids and its impalpable comets swarms in a vacant universe that almost defeats the imagination. Beyond the orbit of Neptune there is space vacant so far as human observation has penetrated, without warmth or light or sound, black emptiness, for twenty billion miles or more. That is the smallest estimate of the distance to be traversed before the nearest of the stars is reached. And save for a few comets, more unsubstantial than the thinnest flame no matter what ever human knowledge crossed this gulf of space until early in the twentieth century. This strange wanderer appeared.

A vast mass of matter it was, bulky

*Continued on page 1072*

# Changing the Gulf Stream

What Would Happen if Various Parts of the World, Particularly New York City, and the Atlantic Seaboard of the Gulf Stream Could Be Changed in Its Course so as to Follow Along the Atlantic Coast and Not Dart Northeastward Toward Europe Shortly After Leaving Florida is Shown in a New Film Story. The White Arrows Indicate the Path of the Cold Labrador Current; the Black Arrows the Gulf Stream.

This Picture Shows a Later Stage in the Story of Changing the Gulf Stream, the New Paths of This Warm Current Close to the Atlantic Seaboard Including Newfoundland Being Shown by the Black Arrows and the Modified, Southerly Proceeding Labrador Cold Current by the White Arrows. It is Proposed to Deflect the Labrador Current by Means of a Long Baffle Wall or Dam.

This Picture Shows Three Different Positions of the Flexible Mesh-Like Dam Supported in Position by Anchor Buoys. The Upward Movement of the Mesh-Like Curtain Takes Place, Due to the Constant Movement of the Ocean Currents. Silt and Mud Washing In and Catching in the Dam.

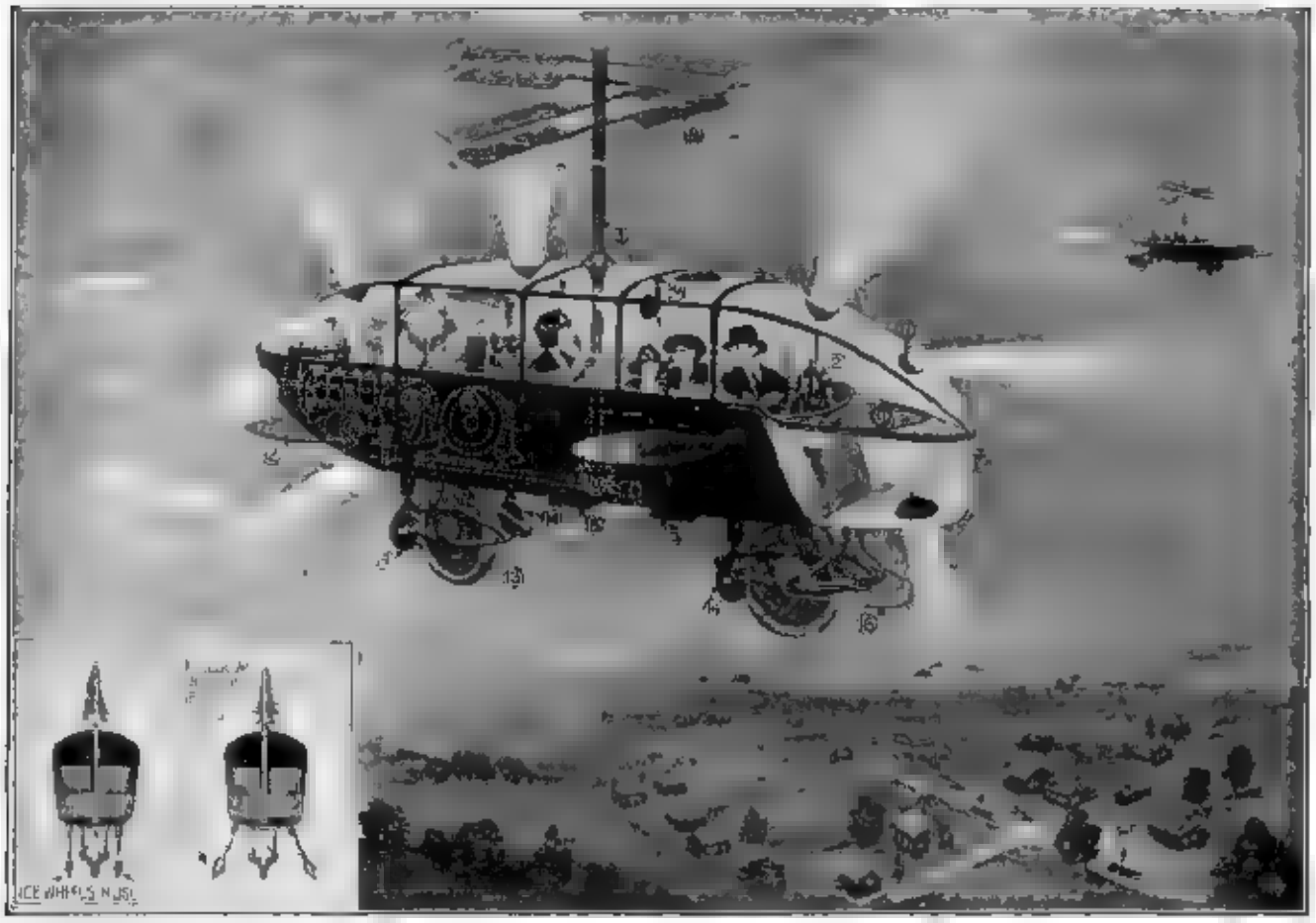
The Action of the Silt and Mud Carried Forward and Caused to Form a Dam or Wall in Connection with the Mesh Curtain, is Shown Progressively in the "Movie" and Finally the Completed Dam or Baffle Wall is Seen. The Ocean Depths at Various Points About Newfoundland Where This Wall Would Have to be Constructed, Are Shown in the Film Story.

View of the Hotel Plaza and Entrance to Central Park, New York City, as it is at Present. According to the Theory Set Forth in the New Film Story and Which Has the Sympathy of a Great Many Scientists, if We Could Change the Course of the Gulf Stream We Would Do Away with the Severe Winters.

Here is a View of the Hotel Plaza and the Entrance to Central Park as it Would Appear if the Gulf Stream Could Be Changed. Monkeys Would Climb Cocoanut Trees along Broadway, and Bananas and Oranges Would Be Had for the Asking, if This Great Dream Came True.



Photos from Key Productions.



THE "HELICAR" OF TOMORROW—IT FLIES OR TRAVELS ON ROAD

1—Push Button Power Control Board Before Driver, Which Also Switches Power to Helicopter Drive Shaft 3, and Blades 9, When it is Desired to Fly.
2—Steering Wheel.
3—Helicopter Drive Shaft.
4—Gyroscope for Stabilizing Car on Two Wheels.
5—Twelve Cylinder Gasoline Engine Driving Large Dynamo 6, Which Supplies Electric Current to Motor Within Rear Wheel, 13.
7—Storage Battery for Engine and Radio Receiving and Transmitting Set, 8.
9—Collapsible Helicopter Blades. (Note Engine Drives.
10—Powerful Electric Lamps and Reflectors for Flying Purposes.
11—Elevating Wings Controlled by Driver, Used in Ascending or Descending, as Well as Tail, 12.
13—Electric Motor Wheel Which Drives Car Along Road.
14—Motor Driven Spur Wheels Which Can Be Lowered to Assist in Propelling the Car Out of Icy Spots.
15—Collapsible Steps.
16—Fender.
17—Electric Headlight Used When Running on Road.

# The Automobile of 1973


## By H. GERNSBACK

MEMBER OF THE AMERICAN PHYSICAL SOCIETY


THE modern automobile, as far as the public is concerned, is only about 25 years old. It is true that a few cars were made as much as 30 years ago, but these were not for universal use, and only millionaires could afford them. The first cars were very crude, and were not at all reliable, and when we look back upon these high-wheeled two-seaters we smile at the contraptions that they were.

The other day an automobile of that early vintage rolled down Broadway. It was running under its own power, but the sight was so ludicrous that it stopped all traffic, and every one had a good laugh at this piece of ancient mechanism.

25 short years were enough to produce this result. What, then, may we expect to see 50 years hence? What sort of automobile will we ride in? What will be commonplace 50 years hence?

The automobile, as it is built now, tends to become larger and larger. The car of today is fully three times as large as the car of 25 years ago. In our large cities overcrowding, due to the tremendous number of automobiles, has now reached the saturation point. New York City is about to enact a law to eliminate a certain number of taxicabs, which now crowd the streets to such an extent that it is impossible to make any time at all in certain sections of the city. If you really wish to move rapidly, you have to take the subway or the elevated railway. This condition exists in most large cities. It has been proposed to build viaducts over the house tops, but due to the high cost it is doubtful if such a plan will ever become a fact, even in a time remote from now.

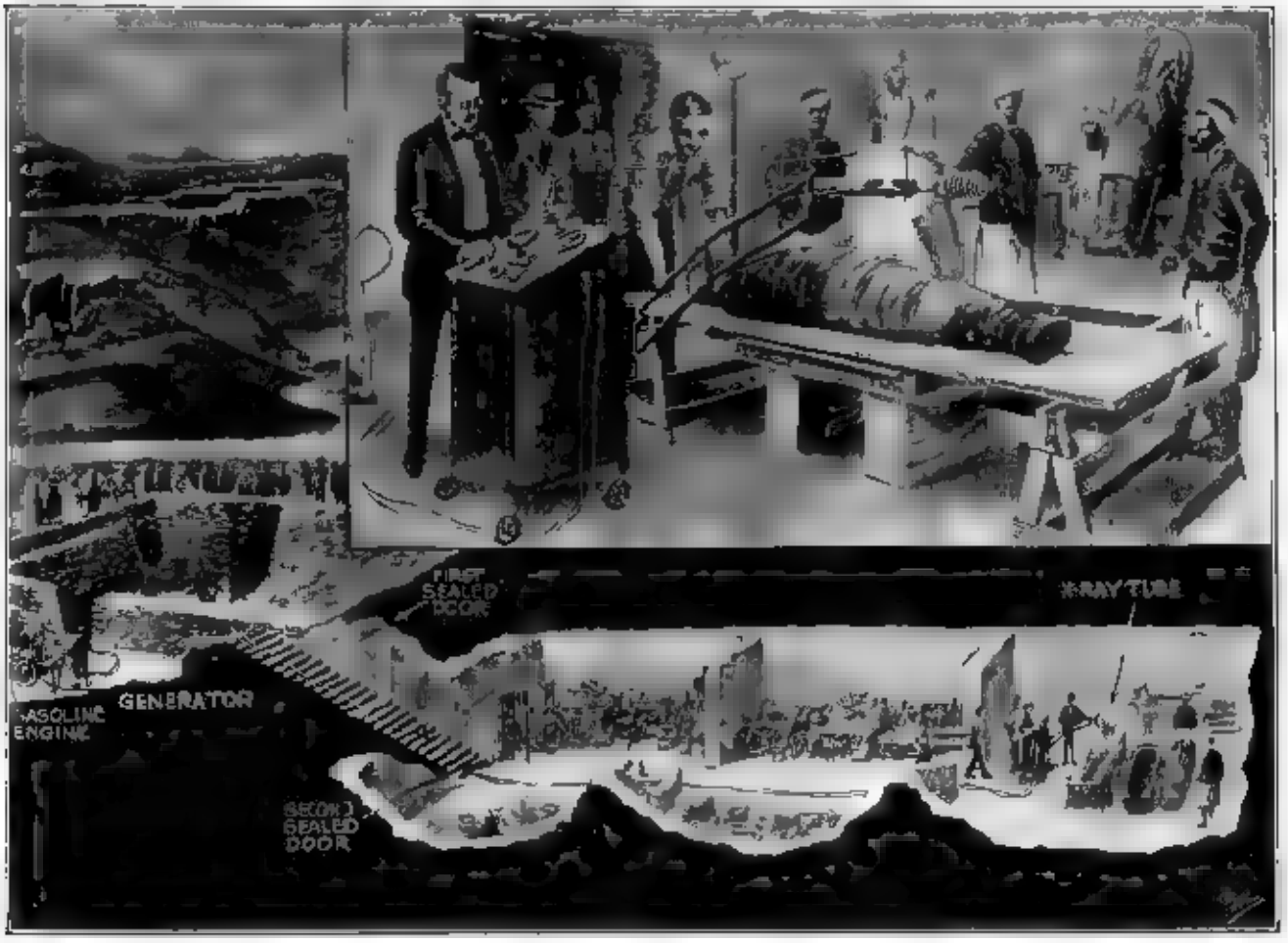
The only practical solution is to combine the automobile with an airplane and this no doubt will happen during the next few decades. The He-copter Automobile or, for short, the *h-bear* will not take up very much more room than the present large 7-passenger automobile, nor will it weigh much more than our present-day car, but instead of rolling down the avenue, you will go straight up in the air, and follow the air traffic lines, then descend at any place you wish. This descent can be made in the middle of the street, if necessary. The car may roll through the street, and may rise in an open place, or square, of which there will be many in the future.

While it will be possible for a car to alight on the ground in a narrow street, traffic regulations may prohibit this, and the aerial ascent and descent will be made from these public squares or parks. The Helicar will be particularly useful for suburbanites to fly to and from work, and for pleasure. Even today our roads, whether they be suburban or country, are so clogged with traffic that it is impossible to get anywhere on time.

Our front cover illustration shows the Helicar moving through one of our future streets, as an automobile, while the illustration on this page shows the Helicar as a flying machine.

It will be noted that only two wheels are used. Two wheels are more economical than four. There is less trouble with gears and shafts, and this construction decreases the weight of the car as well. A gyroscope keeps the car in an upright position at all times, and makes riding on two wheels perfectly safe.

Two-wheel vehicles are not new, as witness the bicycle. The famous Englishman, Brennan, has already tried them out, and there will be no reason for using four wheels in the future.

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**It Has Been Proposed That at Some Later Date When the Inner Chamber of Tut-ankh-Amen's Tomb is Opened and His Mummified Body Exhumed, That X-Ray Photographs of His Body Be Made in Order to Learn as Much as Possible About Its State of Preservation. There Was Considerable Doubt in the Editors' Minds as to Whether the Bones of a Mummy Would Show in an X-Ray Photo. In Order to Determine What Might be Expected in X-Raying Tut-ankh-Amen's Body, Special Arrangements Were Made with the Museum of Natural History at Which Place We Were Able to Take Large X-Ray Pictures of a Peruvian Mummy About Four Hundred Years Old, the Results of Which Are Shown in the Large X-Ray Skeleton Picture on the Opposite Page. The Illustration Herewith Shows How the X-Ray Apparatus, Supplied by Curtis from the Dynamo Driven by a Gasoline Engine on a Truck or Otherwise, Will No Doubt Be Employed by Lord Carnarvon and His Experts.**

# First X-Rays of Mummies

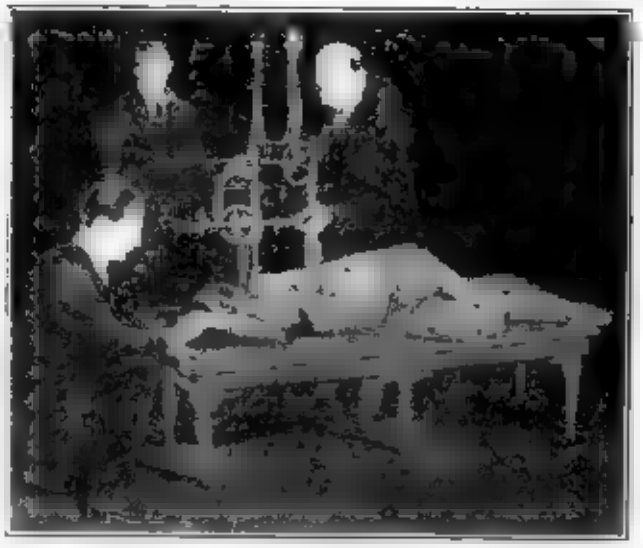
## By JOSEPH H. KRAUS

STAFF MEDICAL EXPERT

**Do you know why Egyptians preserved the bodies of [redacted] how these were preserved? Do you know the uses to which chemistry is put in modern times to continue to preserve these objects? Do you know the type of religious rituals in vogue at the time of King Tut-ankh-Amen? Do you know that the X-ray can be used in many ways to assist us in the study of the ancients? These and many other questions are answered in the following article.**

THE discovery in the Valley of the Kings, near Luxor, Egypt, of the royal Tut-ankh Amen caused quite a furore in scientific circles. Other important discoveries were given but a small space in the back columns of the newspapers, while King "Tut," as the headline writers label him, occupied the first pages.

Were it not for the extreme dryness of the climate and the almost airtight character of [redacted] where these treasures described by the newspapers were found, they would have crumbled to dust long ago.



**The Photograph Above Shows the Author of the Article and Dr. Charles W. Mead, Curator of the Peruvian Department of the Museum of Natural History, New York City, Who Kindly Cooperated with the Editors in Making the Very Interesting and Original X-Ray Sciagraphs of a Mummy Four Hundred Years Old, This Mummy Being That of a Peruvian Indian.**

The discovery of the royal tomb was made by George Edward Stanhope Molyneaux Herbert, fifth Earl of Carnarvon, popularly known as Lord Carnarvon, although the actual work was done by an American named Carter.

### X-RAYING THE MUMMY

Some mummies fall to dust the moment they are touched, or at the very instant the sarcophagi are opened. In others, it is impossible to differentiate between bitumen and the bones.

It has been suggested that Lord Carnarvon use an X-ray on the sarcophagus before attempting to open it to determine whether or not there is a body contained therein, and if so, whether it would be safe to open the

sarcophagus. We have been told that it would be impossible to take X-ray photographs of a mummy because the bones would be just as transparent to the rays as the tissues of the body. Accordingly, we prevailed upon the Museum of Natural History of New York to loan us a mummy for the sake of experiments. Not only having received their consent but their earnest cooperation in this experiment, and particularly that of Dr. Charles W. Mead, the curator of the Peruvian Department, we asked the Kny-Scheerer Company of America to supply us with one of their X-ray machines. Being interested in the experiment, their X-ray technicians were present for the momentous occasion. While newspapermen stood around and moving picture cameras clicked, we proceeded to diligently X-ray a mummy, section by section, as our photograph clearly indicates. The photographed sections were then matched, one fitting against the other, and a complete photograph was obtained. This photograph is reproduced here and shows to what extent our results were satisfactory.

A bedside unit was the type of X-ray apparatus employed. A completely shielded tube of the Coolidge type with the heated element having an extremely high penetrative value, was used. The voltage delivered by this machine was above 300,000 volts. The only difference in taking these pictures was that the exposure had to be increased fourfold. The reader will notice how the fractured rib stands out boldly in this photograph. This is the first time an X-ray photograph of a complete mummy has been taken.

The proposed plan to be adopted by Lord Carnarvon is graphically shown in the illustration at the head of this article. Here we see the actual location of the first and second chambers, as well as the location of the third chamber where the sarcophagus of the King is expected to be found. In the tomb of Seti II, the chemical laboratory is located. This is not indicated in the diagram. Outside of King Tut-ankh-Amen's post mortem abode, we see the gasoline engine on a truck driving a generator. The cables from the generator pass down the stairs through the first and second chambers, where they supply current not only for the lights of the motion picture photographer, but for the X-ray apparatus. Having examined the sarcophagus by means of a fluoroscope to determine whether or not it would be safe to disturb the body, it is moved from its position while the dust of centuries falls from its sides. With great care it is placed across some adequate support and the X-ray pictures are taken in full size. It is quite evident that theft of the mummy could be easily detected, and identification of the King becomes possible by means of the X-ray as no two mummies are exactly alike. The bone markings heretofore claimed to be undetectable and found to be positive and sharp in our research, would also assist in the identification.

New types of lamps were shipped to Luxor, so that the

(Continued on page 64)

No, This is Not King "Tut," But the Nearest We Could Come To It in Making an X-Ray of a Mummy, as Lord Carnarvon Proposes to Do with Tut-Ankh-Amen's Mummified Body When it is Removed from the Inner Tomb, Possibly Six Months to a Year from Now. This Composite X-Ray Picture is the First Complete Skiagraph of a Mummy, So Far as the Editors Are Aware, and Required a Whole Day's Work by a Corps of X-Ray Experts, with the Cooperation and Assistance of Dr. Charles W. Mead, of the Museum of Natural History, New York City. The X-Raying Was Carried Out by the Author with the Cooperation of Dr. Mead and Mr. Stoye of the Kny-Scheerer Company, Who Furnished the Powerful X-Ray Machine and High-Power Coolidge Tube Necessary in Taking These X-Ray Pictures. The Skiagraph Shows Clearly the Fractured Rib of the Peruvian Indian. The Size of the Mummy Corresponds to That of the Average Man of Today.

This Mummy is About Four Hundred Years Old, and While the Editors Were Very Doubtful Whether the Bones Could Be Differentiated from the Mummified Flesh and Muscle Tissue, the Results Clearly Show That Very Excellent X-Ray Pictures Can Be Taken of King Tut-ankh-Amen. The Main Difficulty in Taking These X-Ray Pictures of the Mummy in the Museum, as Compared with Taking Such Pictures of the Live Subject, Was That the Exposure or Time During Which the X-Rays Were Permitted to Pass Through the Body on to the Photographic Plate, Had to be Increased Fourfold.

It Was Hoped That Some of the Internal Organs Might Show Up on the X-Ray Plates, But as This is Seldom the Case with Live Subjects, Unless They Have Been Given a Bismuth Meal, This Did Not Occur.

The Three White Lines on Either Ankle Indicate Straw Anklets Found on the Mummy, and the Only Clothes Consists of a Cloth Girdle About the Loins. The Peculiar Position of the Body Was That in Which the Mummy Was Found in a Copper Mine in Peru, and it is Thought that the Copper Sulphate Present Had a Great Deal to do with the Preservation of the Body. This Also Made the Mummy Much More Difficult to X-Ray Than That of Tut-ankh-Amen, Owing to the Copper Deposits and Infiltration Present.

shades and colorings of the precious stones and the texture of materials may be the more readily seen. The light gives a diffusion similar to daylight and of a color identical with that obtained from a north sky window. The claim made by some scientists that the bodies of the Egyptians were mummified, not due to the method of embalming, but due rather to the dry climate which is found in Egypt is in the writer's opinion, incorrect. If this were the case then every mummy from the first dynasty to about four

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# HOW-TO-MAKE-IT NUMBER

June

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# X-Ray Movies of the Body

**By A. P. PECK**

ON account of the wonderful advances made in motion picture production within the past few years, the title of this article should not be a surprise. When one can see the "impossible" feats performed in the movies, it does not take a very great stretch of imagination to picture to one's self X-ray movies. A leading electrical manufacturing concern has produced a two-reel film entitled "Revelations," which deals with the production of these rays as well as with many of their uses.

In connection with this film, animated drawings are used for depicting the process of the production of X-rays. The electrons are shown passing through the space within the tube and striking the target; the paths of the X-rays thrown off from this target are shown by dotted lines. As is usual in this type of cartoon or drawing the action is followed through very accurately and a wonderful amount of knowledge regarding the production of X-rays is obtained by viewing the picture. Of course, one must remember that particles of matter invisible to the eye are recorded on the film in great and exaggerated size. This is especially true in the case of the electron streams and the X-rays, the constituents of both of which are invisible to the human eye. The former are, however, for clarity's sake, enlarged in size many millions of times and are represented on the screen by very large dots. The speed of flow is at the same time reduced so that they can be easily seen, and when they strike the target within the tube, they appear to burst in a manner which resembles strikingly an explosive shell from a gun hitting the earth. From the point of impact the X-rays are shown shooting off in progressive lines.

After the showing of these animated drawings various uses of the X-rays are shown in a very comprehensive manner. For instance, the interior of an up-to-date dental office is shown and the method of taking X-ray photographs of the teeth is entered into. It is shown how a small strip of photographic film is placed within the mouth of the patient and the X-ray tube brought in proximity to the side of the patient's face. The tube is then actuated for a few seconds, whereupon the exposed film is removed and developed. Of course, during the entire process the strip of film is kept covered by being placed in a black envelope to protect it from ordinary light rays, but the X-rays penetrate this with greatest of ease.

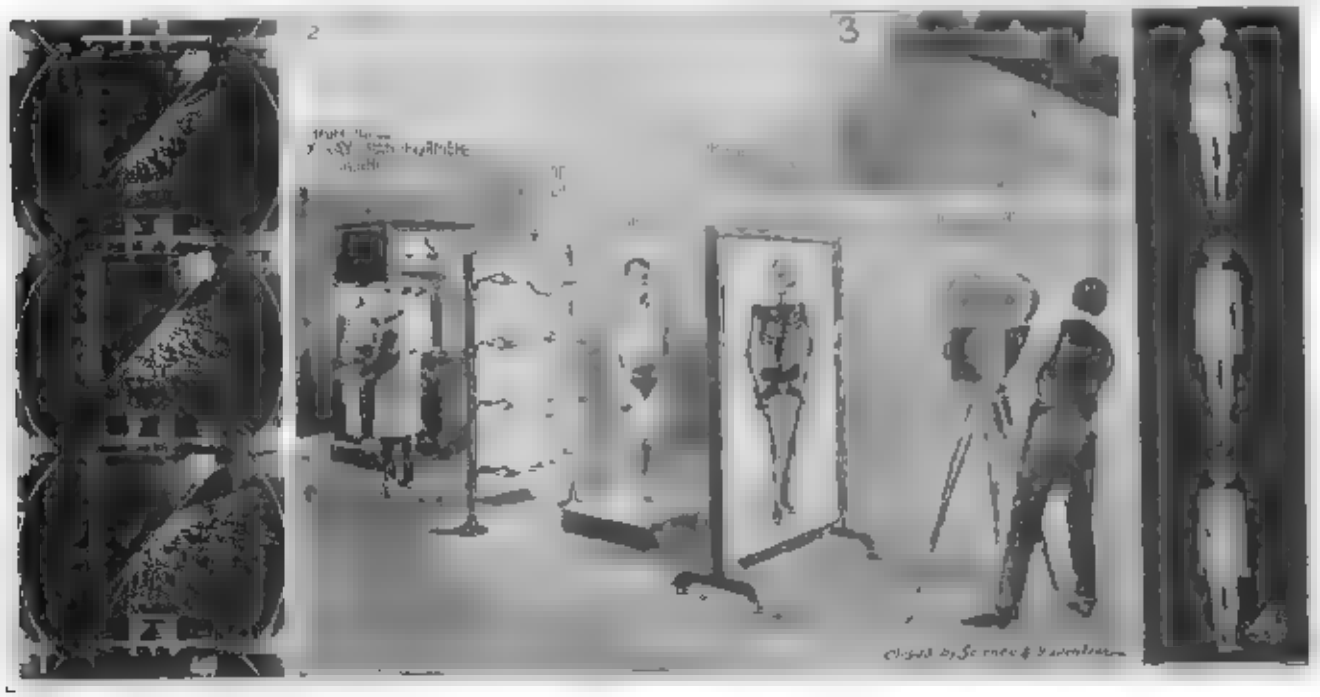
Various types of X-ray apparatus are shown together with many of their uses in hospitals and other institutions. It is shown how the tube can be placed in many positions such as under or over a patient reclining in a bed, in order to secure photos from various viewpoints.

One of the most spectacular portions of the film is that showing an X-ray photograph of the entire human body. When one considers that a single X-ray tube will only take a portion of the body at one time, the stupendous amount of work necessary for such a photograph will be realized. It is necessary to employ a battery of X-ray tubes arranged in a very particular manner for making this photograph and our illustration, in a somewhat simplified presentation, shows a method of doing this work.

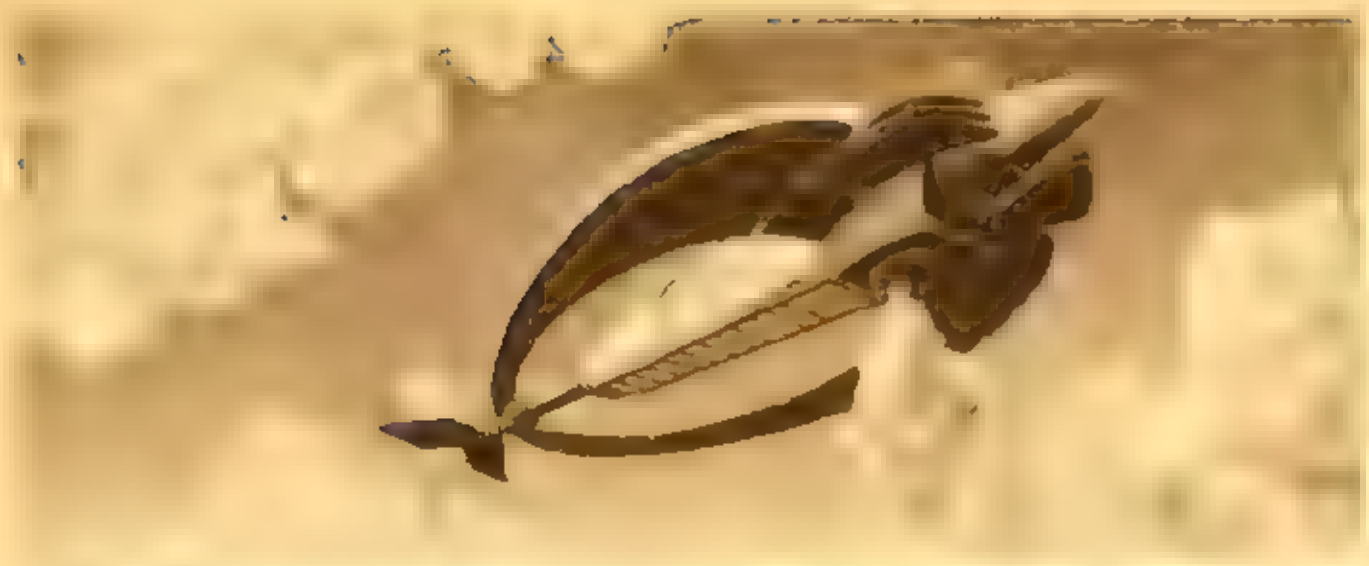
As is well known, the continuous exposure of the human body to the influence of X-rays is highly injurious to the tissues and in cases has resulted in the necessity of amputating the hands and arms of workers continually exposed to these rays and has led a number to die. The X-rays have been found valuable in treating cancer, wherein they are used to "burn" away the diseased tissue. Obviously if they will attack the latter they will also destroy healthy tissue and for this reason the X-ray technician shown in the illustration must necessarily wear protective clothing. The rays will not penetrate lead and, therefore, he wears a coat composed of a metallized fabric having lead as its base. His gloves are made up of the same material and a lead helmet protects his face and head. In the front of this helmet are openings covered with a [illegible] kind of lead glass, which protects the eyes from the rays but still allows the wearer to view his work. It is the constant exposure day after day to X-rays that results in complications, and therefore, a patient can be safely exposed to [illegible] warm being done.

Now in order to take a photograph of the entire human body at once, it is necessary that a large number of tubes be employed [illegible] tubes. The subject to be examined or photographed is placed between this bank of tubes and a fluorescent screen. On the opposite side of this screen from the subject is set up a movie camera. Now when the X-ray [illegible] is thrown upon this fluorescent screen and may be photographed by the operator of the camera. Extraordinary results may be obtained in this manner, and a strip of film taken from the motion picture mentioned above is shown on the right of the illustration.

The value of such photographs to the physician can easily be understood. He will be able to examine the entire body from one photograph without the necessity of making several exposures with consequent danger to the patient from exposure.—*Photos Courtesy General Electric Co.*




**On the Left of the Above Illustration Is Shown the Cathodic Bombardment Which Takes Place In An X-ray Tube, As Depicted By a New Motion Picture Film. The Center Illustration Shows the Method Used In Taking X-ray Motion Pictures. A Whole Battery of Tubes Connected In Series Produces the Image On the Screen Coated With Barium Platino-Cyanide. At the Right Is a Strip of Motion Picture Film Showing X-rays of a Complete Human Body All the Bony Movements May Be Seen In This Picture, and Inserted In the Illustration Is An X-ray Photo of the Teeth**



"Suddenly a Piercing Light Shone Upon Us Through the Open Window and, Looking Out, We Beheld the Most Grotesque Air Machine We Had Ever Witnessed. It Appeared To Be a Huge Box-Like Structure With One Circular Opening, Which I Judged To Be About Six Feet In Diameter. This Opening Was Centrally Located In the Bottom of the Machine, and From It a Dense Yellowish Gas Was Issuing In Great Clouds. Directly Beneath the Machine Were the Immense Stockyards of the City."

# The Great Food Panic

## By BURNIE L. BEVILL

CARL HOLT and I sat alone in our private office at the rear end of the corridor of the seventy-eighth story of the Zolberg Building in Kokomo. It was in the latter part of ——— of the year 1950, and the weather being extremely warm we had discarded our coats, and were busily engaged in the difficult task of managing the affairs of the Watermotor Company. The Watermotor Company was organized in the year 1937 by that famous inventor and scientist, John L. Gorman, after he had perfected and patented his epoch-making engine, which had revolutionized the manufacturing and transportation industry of the world by utilizing a source of power that was procurable without cost, namely water.

The method employed by Gorman was very simple. Water in its normal state, just as it is pumped from the earth, was made to pass into an enormous electrolytic bath, which was supplied with a powerful current of electricity from a dynamo, that was operated by the same engine. In this electrolytic bath was a very light solution of trioxic acid, that extremely active and powerful reagent, which has the power of acting as a catalytic agent upon water, causing it to decompose into its constituent parts, hydrogen and oxygen, by the application of only a weak current of electricity. By passing a strong current through the water in the bath hydrogen and oxygen were liberated in enormous quantities and drawn into the cylinders of the engine, where they were made to explode with tremendous violence by the electric spark, just as in the old style gas engine, that was in use thirty years ago.

This invention had created a sensation in the industrial world and, consequently, the spectacular rise of the Watermotor Company was to be expected. From a tiny building of only a few rooms that were used by Gorman for his workshop and laboratory in Kokomo, there had developed a vast structure of stone and steel that had taken its place at the top in the list of the world's greatest buildings. The business of the company covered the entire world, and the income of the stockholders was in excess of $500,000,000 per year.

Carl and I were not directly connected with the Watermotor Company, but inasmuch as we had been employed as members of the United States Secret Service we considered that the company's business was our business. Reports had been circulated to the effect that there had been seen hovering over the World Food Corporation's immense structure in Frankfort, a huge, bird-like machine, the like of which had never been heard of before. It was said further that there seemed to emanate, from a large opening in the craft, a yellowish gas that was odorless and tasteless, and, apparently, harmless. But upon investigating the purity of the food which was a product of the plant, it was discovered that it was coated with a yellow film. It was observed that the machine never came within five miles of the surface of the earth, and great were the speculations concerning the purpose of this gigantic craft.

The Zolberg Building is the huge structure in which were located most of the offices of the largest manufacturing plants of the world. Several minor matters had arisen in connection with the affairs of the Watermotor Company, and Carl and I had been enlisted in its service to investigate. It was in this occupation that we were engaged at the present time. Without warning, the door burst open, and a newsboy rushed madly in, screaming his wares.

"Three thousand men killed at the food plant this morning. All employees of the company," he yelled.

With a gasp I snatched the paper from his hand, tossing him a coin. A glaring red headline adorned the top of the page—"FOOD PLANT MYSTERY," it read. Perusing the lines hurriedly, I read, "Frankfort, Ky., July 31—What is proving to be the most puzzling mystery of the age was

(Continued on page 168)

# Doctor Hackensaw's Secrets

## By CLEMENT FEZANDIÉ

## No. 17—The Secret of the Walking Radiobile

*(Author's Note—The automobile has accomplished wonders, both for the transportation of passengers and merchandise. Its one great drawback, however, is that it requires good roads. Isn't it about time that our inventors should turn their attention to giving us an auto that could climb over fences and travel through rough fields?)*

"ARE you all ready, Silas? We ought to start in about an hour." "How are you going? By the tram?"

"No, I'm going in my 'Walking Radiobile.'"

"A walking radiobus? What in the world is that?"

"That's my latest invention. It's an automobile that walks."

"I confess I'm no wiser than before, doctor," said Silas.

Doctor Hackensaw shrugged his shoulders. "The fact is, Silas," said he, "that I have made a new automobile, which I think is destined to be of the greatest value both in peace and in war. I, of course realize fully how much we are indebted to our present autos, but they all have one very serious defect—they require good roads. Now the majority of roads are bad, and it takes time and money to improve them. What we need, therefore, is an automobile that can travel the poorest road, cut across fields, climb over fences and wade through small streams."

"Won't a tractor do that?"

"Yes, but a tractor is too slow, too heavy and too clumsy. Besides, it destroys everything in its path. Now it struck me that a light automobile with four legs would fill a long-felt want, for it could walk over the roughest ground, climb steep mountains, and even step over a high fence with ease. As you are going to ride out to Michigan with me to inspect the timber-lands there that I am about to purchase, you will have a chance to see for yourself how the thing works."

"Why do you call it a *radiobile?*"

"Because it is run by radium. I've already spoken to you about my radio-engine, but you haven't seen it yet. As I told you not long ago, I can manufacture radium in large quantities and very cheaply. Radium is an unstable substance, continually giving off powerful emanations, and eventually disintegrating into lead. One gram of radium, in turning into lead, gives out some three million horse-power hours of energy. Under ordinary circumstances it would take about two thousand years for the radium to change into lead. In other words, one gram of radium could furnish one-sixth of one horse-power continuously day and night, for two thousand years! But I have found that by heating the radium I can greatly hasten the disintegration. In my radiobile here, I apply heat at will to the tube of radium that runs the machine, and by means of the heat alone I can regulate the speed of the machine. If not used at all, my radium lasts two thousand years. If I use it to run a 20 horse-power machine six hours per day the machine would run for over seventy-five years, which is about all that any reasonable man could ask."

"You told me that you used the ocean waves to get the heat required for making the radium."

"Yes. You understand, of course, that since a gram of radium in turning into lead, gives off three million horse-power hours of energy, I cannot change a gram of lead into radium without using up *at least* three million horse-power hours of energy. As a matter of fact it takes fifteen million horse-power hours to make a gram of radium. But I consider that very little, as the ocean waves furnish the practically unlimited power."

"Only twenty per cent efficiency!" exclaimed Silas. "That seems very low."

"On the contrary it is a remarkable show-

(*Continued on page* 166)

"The Machine Left the Road and Approached the Fence That Bounded the Woods. A Quick Shift of a Lever Transferred a Weight To the Rear of the Car and Lifted the Front Legs of the Machine Over the Fence. Another Shift and Down They Came On the Other Side. A Reverse Operation Brought the Hind Legs Over."

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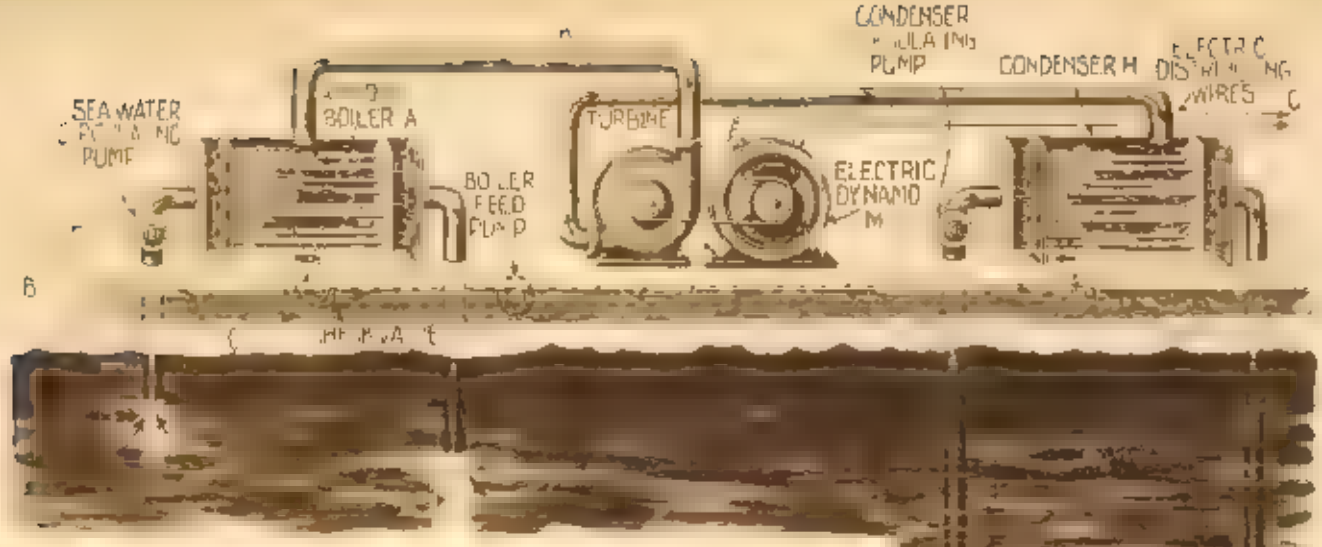
See Page 257




# Electricity from Sea Water

THE Italian papers for some time have been speaking of a sensational invention which is attributed to a certain Signor Boggia, and which is supposed [illegible] to furnish immense quantities of energy at a very low price. Professor Doring, who has collaborated effectively in his work with Signor Boggia, has given a lecture in Milan before the Engineers' Society, which gives a certain authority to the ideas which we are going to express here.

He treats in short of a new way of directly utilizing solar energy which the earth receives from the rays of our great luminary, and which is really enormous. Professor Doring estimates that the earth receives thus each year on the average at least one hundred thousand times more energy than that which could be developed from the coal extracted from the bowels of the earth during the same period.

The various attempts made up to the present time, including that of Archimedes, of utilizing the solar energy directly by means of converging mirrors or otherwise, has the great defect of being very expensive. The enormous amount of energy at our disposal being realized, it follows that it is better economy to sacrifice efficiency of utilization to reduction in the capitalization costs for the installation of the plant. For this reason our inventor prefers to collect the solar energy at a low temperature, rather than to try to raise the temperature by means of the methods alluded to above.

### THE LARGEST BOILER IN THE WORLD

For this purpose, he proposes to construct a gigantic boiler, which without fear of contradiction can be called the largest boiler in the world. To make it more intelligible, we think it will be useful to put into a few words the principles of the boiler and of the steam motor.

A standard form of boiler is a large metallic vessel closed, and containing water which is submitted to the action of heat liberated in a fire. The water is thus converted into vapor, which is used in one of the two following methods. This vapor can be sent into a reciprocating machine, comprising a cylinder, in which under the action of the steam pressure, a piston receives a reciprocating motion back and forth through the said cylinder, or the steam can be sent into a turbine consisting of a drum with wings or paddles the steam acts by its spred on these wings and turns the drum. The reciprocating engine or the turbine may for example, drive an electric generator or a dynamo.

But what becomes of the steam as it leaves one of the other of these machines through the exhaust? It can be exhausted directly into the open air, but more often it is passed through a condenser, which is a recipient of sheet iron generally cylindrical in shape, with a certain number of tubes through which a current of cold water is driven by a pump. On contact with these cold tubes the steam liquifies and falls to the lower part of the

Has the Means Been Found at Last for Utilizing the Enormous Reserve Power Which Emanates from the Sun? The Curious Project Which is Described Here and Which is Due to Two Italian Investigators Has the Double Merit of Scientific Precision and of the Picturesque. The General Arrangement of the Boiler and of the Turbine for Utilizing Solar Heat is Here Illustrated. A Ammonia Boiler B Sea Level C Warm Water D Tube Taking From the Surface of the Sea the Warm Water Which Passes Through the Boiler E Exhaust Pipe for Warm Water F Vertical Pipe Fifty Feet in Diameter Bringing Water from a Depth of Three Hundred and Fifty Fathoms for Passing it Through the Condenser G Tube Carrying the Ammonia Vapor into the Condenser H Condenser Liquifying the Ammoniacal Vapor X Tube Conducting the Ammoniacal Vapor from the Boiler to the Turbine L Turbine M Electric Generator N Vertical Tube One Hundred and Fifty Fathoms in Length. Returning to the Lower Level of the Ocean the Water which has Cooled the Condenser O Cables Carrying the Electric Power to Factories Situated on the Shore

condenser, whence it is returned to the boiler. The use of the condenser affords not only the advantage of saving the fresh water necessary for boilers—an important point in the case of ships in particular—but also permits a much higher efficiency of the system.

It is a group of machines of this kind which the inventor proposes to bring together entirely for the utilization of solar heat.

### ELECTRICITY FROM TROPICAL SEA WATER

The best conditions for utilizing this heat according to the inventor are found in the tropical seas where the temperature of the upper layers of the ocean are constant all through the year, in the neighborhood of 25° C. (77° F.), while at a few hundred yards

(*Continued on page 297*)

# Blasting River Bottom Over Subways

THOUSANDS of people who travel back and forth under the East River between New York City and Brooklyn daily probably never know that solid rock is being blasted from the river bottom to a level thirty five feet above the subway tubes. Before exploding the great blast in this great engineering work, which is being carried on for the purpose of deepening the East River channel in order to enable the large warships to find a free passage to the Brooklyn Navy Yard at all tides, a careful test was made by experts who went down into the Clark street tunnel. It is said that a test charge of explosive was detonated in the rocky river bottom only thirty-five feet above the tube, the surface of a glass of water placed on the floor of the tube shook ever so slightly and thus provided reassuring evidence that the work could be carried on over the tubes without undue danger. The rock is not literally blown out of the river which would of course, be liable to cause too severe a shock to the subway tubes, but as Mr. Charles D. Pollen, vice-president of the dredging company carrying on this work said, "We push the rock apart. We do not attempt to blow the reef up. The charge cracks the reef. Then the dipper goes down and rips the boulders chipped off from the parent rock up into the scow. When full, the scow is towed away and that's really all there is to it, except that it takes a lot of planning, a lot of figuring and a lot of

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By Robert E. Lacault

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AROUND THE UNIVERSE—SECOND INSTALLMENT
By Ray Cummings

THE ROLE OF COMPRESSED AIR IN MODERN SUBWAY PRACTICE
By Richard H. Tingley

HOW I BUILT MY FIRST RADIO SET
By Mrs. Dorothy Benkeser

VARIOUS WAYS OF ENLARGING PHOTOGRAPHS.
By Dr. Ernest Bade

### TWO SUBWAYS TO CONJURE WITH

There are two subway systems connecting the lower end of Manhattan Island with Brooklyn, one of them known as the Brooklyn Rapid Transit or Montague Street tunnel, through which trains roar back and forth day and night between Whitehall street, Manhattan, and Court street, Brooklyn, while the second tube, the river bed system is called the Clark Street tunnel, which is used by the Interborough Company. As the river channel afforded about thirty feet of water but with the advent of larger and heavier ships it has become necessary to provide a wider and deeper channel with about forty feet depth of the waterway. As the accompanying illustration shows, this necessitated the removal of about ten feet of solid bed rock along the channel, leaving an average of thirty five feet of solid rock above the subway tubes.

The big handicap to making the immediate deeper is Diamond Reef which is an exceedingly hard rock formation sticking up in the river bed. This task of deepening the channel to a forty foot depth involves what amounts to under-water rock quarrying will be added complication that considerable rock must be excavated directly over the subway tubes, and this engineering project is considered one of the most difficult and

[illegible] in recent years.

### [illegible] BOAT AND [illegible]

The two most important factors in carrying out this work are the drill boat and the dredge boat. The drill boat is a large floating platform supporting three drill frames, a steam power and [illegible] structure housing the crew and machinery. On the drill frames about twenty feet above the water are the steam engines that operate the drills. Thirty feet below the surface of the water, these powerful drills, spaced ten feet apart, twist and bore into the solid rock to a depth of ten feet.

When the holes have been drilled and the tide is right, charges of 80 and 90 per cent du Pont gelatin are packed into lengths of galvanized iron leader pipe and lowered into the holes. It is then but a moment's work to connect the wires leading to the charges with the electric blasting machine. The drill boat moves away about seventy-five to one hundred feet riding on her anchor chains, and the preparatory work is done.

The shot firer who is aboard the drill boat takes up his station and turns his eyes shoreward. He signals that he is ready and an inspector on the pier raises a red flag indicating that he has seen the signal and that his assistant is telephoning the Brooklyn Rapid Transit Subway train dispatcher. The telephonic wire remains open as the dispatcher watches the green signal [illegible] flickering across the chart before him.

train as it moves through the tube is indicated on the chart board by a light flash which moves progressively along as the trains pass the block signals. He holds up other trains from entering the tunnel and as the last green light fades, indicating that the tunnel is cleared of all trains, he gives the word by telephone to the inspector's assistant.

### FIRING THE BLAST CHARGE

The red flag drops, the shot firer aboard the drill boat sees the signal and pushes down on the handle of his blasting machine sending an electric current through the wires to the charges of great explosive in the holes in the rock below and the force of one hundred pounds of dynamite is released.

Forty feet below, the rock has been shattered but there is so little disturbance of the water at the surface that unless someone points out to you a circle of foam surging up from the bottom of the river it would probably escape your attention. It is gone a few seconds later. The subway trains are passing through the tunnels again within ten seconds after the charges have been fired while the dredge boat with its powerful scoop machinery gobbles up the crushed rock fragments on the river bottom and deposits them on barge scows. The drill boat is then meanwhile taking on the rock drilling apparatus for a row of holes.

It is the intention of the Government engineers eventually to dredge a channel forty feet in depth at mean low water about one thousand feet wide and one mile in total length, extending from deep water in the upper bay opposite Governor's Island, to deep water in the East River beyond the reef at Old Slip. This total area when finally blasted and dredged out will require no doubt several years' work before being finished but this same quantity of rock will not have to be excavated over this entire area, the water in some places is deeper than is [illegible]

## A Useful World's Need

The British Institute of Patentees has started a "What's Wanted" book in which Sir William Bell offers some suggestions as to inventions needed by the world. The list includes:

Glass that will bend.

A smooth road surface that will not be slippery in wet weather.

A furnace that will conserve 95 per cent of its heat.

A process to make flannel unshrinkable.

A noiseless airplane and an airplane that can be managed safely and easily by a boy or girl.

A motor engine of one pound weight per horsepower.

Method to reduce friction.

Practical ways of utilizing the tide.

A process to extract sulphur from vulcanized India rubber so that it can be, so to speak, boiled up and used again.

A pipe that can be cleaned easily and

A temperance drink that will keep and yet not pall upon the palate.

To wrap moving pictures

Blasting the East River Over the Subways Connecting New York and Brooklyn—to Remove Rock Ledges Which Threaten to Cause Trouble by Tearing Up Traffic in the Under River Subway Tubes and Without Any Outward Display of Water Geysers or Flying Debris. This Work is Carried on with a Drill Boat and a Dredge Boat, as Shown. After the Holes Have Been Drilled in the Rock Thirty Feet Below the Water an Explosive Was Loaded Into Each of the Holes and Suitable Electric Caps Were Attached. These Wires Lead Up to a Blasting Machine on the Deck of the Drill Boat and the Man in Charge of the Blasting Signals to a Lookout on Shore When Everything is Ready to Make a Blast. The Man on Shore Then Communicates with the Subway Train Dispatcher and at the Moment When There Are No Trains Passing Through the Under River Tubes He Telephones This Information to the Man on the Boat Who Drops a Red Flag. At This Moment the Blaster on the Drill Boat Pushes the Button and a Series of Charges in the Rock Below Are Detonated.

# Around the Universe

## An Astronomical Comedy

## By RAY CUMMINGS

The Space Flyer on its Way

CHAPTER I

IN WHICH TUBBY BECOMES AWARE OF HIS WONDERFUL GIFT AND ACCOMPANIED BY SIR ISAAC SWIFT DePOE WELLSVERNE, STARTS FOR VENUS.

"THAT ain't so," Tubby spoke up suddenly from the seclusion of his seat across the room. He glanced at the three men who sat around the little table under the circle of light, their poker game temporarily suspended, the cards and chips pushed to one side. "That ain't no solution. Don't you tell me it is!"

"He ain't tellin' you," responded one of the men caustically.

"I ain't sayin' what I think," the first man defended. "I'm tellin' you what he said. The Stars goes right on past the Sun—right to the edge of Space—only there ain't no edge of Space. *That's* what he said."

"You're right, Jake," agreed the second man. "That's what he said."

Tubby glared belligerently, and brought his pudgy fist down upon the flimsy arm of the camp chair into which he was wedged. "That ain't so. There must be an edge o' Space," he snorted. "How can Space go on forever? That ain't got no sense in it."

The first man continued patiently. "He said if you could imagine the edge of Space with nothin' on beyond, that would just be more Space, wouldn't it?"

This question addressed directly to Tubby confused him momentarily. The place where Space stopped with nothing on beyond! Sure that would just be more Space. Then quite suddenly the flaw in the argument struck him.

"You got the wrong idea," he declared condescendingly. "I ain't never said there was nothin' on beyond the edge of Space."

"He's right, Jake," the second man put in. "He ain't never said that."

The first man stared.

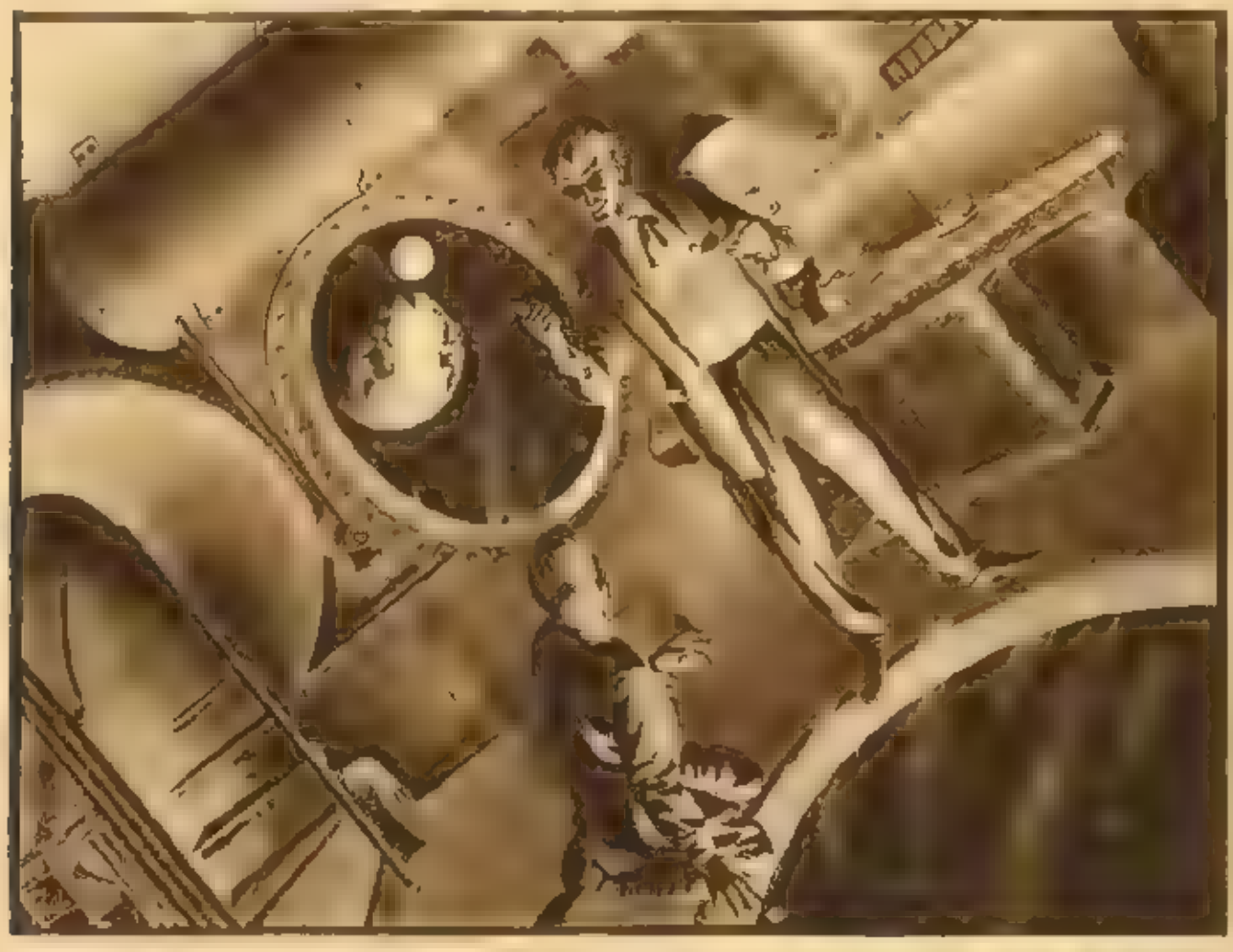
"You're assumin' somethin' you ain't got no right to assume," Tubby went on mercilessly.

(Continued on Page 282)

*THIS is the first instalment of our great scientific novel "Around the Universe" which will run serially in* SCIENCE AND INVENTION *for the next six months.*

*Mr. Ray Cummings is a well known scientific writer of great ability who has several scientific novels to his credit. Mr. Cummings not only is a good story writer but a keen thinker as well. In this series, Mr. Cummings will be bringing out astronomical facts of interest to everybody, in such a way that even a child can understand what it is all about. If astronomy and the theory of relativity is not clear to you, this story will surely explain it in a language that everyone can readily grasp.*

—EDITOR.



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"What's That?" He Asked, Amazed. "I Ain't Never Seen Nothin' Like It. Is That on the Sky Below? Is That Where We're Goin' To? We Must Be Almost There. What Is It? Venus?" "That's the Earth," Said Sir Isaac Calmly. "We Have Turned Over. You See, Because Our Base Is Heavier. We Are Falling Diagonally Away from the Earth, Partly Toward Its Moon and Partly Toward the Sun. I Shall Head Directly for the Sun Later To-Night."

# Skyscrapers of To-morrow

## By H. WINFIELD SECOR

THE latest office buildings of today exemplified by such magnificent monuments of the architects' and engineers' skill as the Woolworth and other similar buildings erected in the larger American cities. The highest of these buildings is the Woolworth office, which towers 792 feet skyward, with its fifty-one stories of offices. The skyscrapers of to-morrow will probably not exceed one thousand feet in height as above this figure they become a decided menace in heavy winds or due to other causes, such as earthquakes, etc. A New York architect and engineer, Mr. Harvey W. Corbett, President of the Architectural League of New York, has designed a new skyscraper of the future which soars upward sixty stories, to a height of one thousand feet, and covering a large city block, such as those extending between the avenues in New York City, or about four acres of ground. Mr. Corbett believes that these new structures, which will come into being probably within the next fifteen to twenty-five years, will combine business offices together with a hotel and apartment house system, and he bases these ideas on the belief that New York will grow more and more to be the great central business center of the world.

### ADVENT OF THE SET BACK SKYSCRAPER

The skyscrapers of the future, believes the architect, will take the form shown in the accompanying picture, with its set back roofs.

The future skyscraper as outlined by Mr. Arnold Brunner, President of the Fine Arts Federation of New York, embodies several interesting engineering developments, especially with regard to the handling of traffic on the streets surrounding such great buildings. New York at present is a city of two levels, one on the surface, and one underground. No doubt in the future we will have at least three levels of traffic, one underground, that on the surface, and another above the surface. The underground arteries of traffic will comprise subways, underriver tubes, etc.

Motor trucks and other heavy vehicles will have possession of the street or ground level with passageways through arches built under the large buildings, while an elevated roadway above the street level proper will accommodate pleasure vehicles and pedestrian traffic.

A suggested solution of the traffic problem is shown in the accompanying illustration drawn by Mr. Warden, wherein the pedestrian traffic taken place along walks possibly twelve feet or more in width, supported on brackets or otherwise against the building walls. It is easy enough to design schemes for providing different levels of traffic, as those here outlined and pictured, but it must be remembered that the engineers behind the government of our large cities have been striving steadily to eliminate elevated structures of the type which tend to darken the streets below.

No doubt before a great while we will be provided with some newer form of clear and strong transparent material, resembling glass, which can be used for the road bed of such elevated roadways, so that the light will shine right through it. By keeping such roadways separated in two narrow lines passing up and down on the opposite side of the street in a similar manner to the arrangement of the elevated railway structures in some cities now, plenty of illumination is allowed to reach the main street level between the track structures. One thing is certain, and that is, that people are not very fond of traveling in subways, but they do not have any choice in the matter, as they are provided by the engineers who lay out our cities and transportation facilities, and they are we have to admit it seems a necessary evil to some extent at least. However the editors have always had in mind that it should certainly be possible to solve some of our urban traffic congestion problems by providing one or more elevated roadways generally, if care is taken to see that the street view below is not cut off almost entirely from fresh air and light.

The accompanying picture shows the proposed skyscraper of the future contrasted with the Eiffel Tower which measures one thousand feet in height, and the present building of skyscrapers, the Woolworth Building which is 792 feet in height.

### LANDING AIRCRAFT ON ROOFS

One feature of to-morrow which appears a promise to become as prominent as mosquitoes in the summer time, is the provision made for landing planes on the roofs of buildings. To-morrow, building roofs will no doubt be found useful for aerial landing and starting purposes, as the U. S. Naval aeronautical experts have at last perfected the catapult for projecting the planes into the air at the rate of fifty miles an hour, and a remarkable test described several issues ago, whereby an airplane can be stopped within a short space. With the development of the helicopter, which is just now starting to come into prominence, the airplane of to-morrow can be made to rise straight up or down.

# Submarine Tractor and Vertical Pontoons to Salvage Ships

By ERIC A. DIME

TREASURES hidden in hulks resting on the bottom of the sea have inspired inventors from time to time to try to originate ways and means whereby the wrecks could be raised and their valuable cargoes salvaged. The idea of salvaging sunken vessels is now receiving possibly more attention than it ever did before in marine history and the reason for this interest is found in the immense tonnage of ships that were torpedoed and lost during the great World War.

The salvaging of wrecks in shallow water has been going on for some time, and the greatest depth from which large ships are known to have been raised is seven-two feet. But vessels resting at depths of from 100 to 300 feet have never been brought to the surface for the reason that up to the present time there has been no efficient or practical system in use whereby the vessels could be raised. Nearly all salvaging methods applied up to the present time have involved either the attaching of cables to the hull of the ship in such number that the ship could be carried by them as her weight was overcome by means of some lifting power exerted from the surface. The lifting is assisted by means of compressed air forced into such compartments of the vessel as could be made air-tight, the strain on the chains could be diminished by a combination of the two methods.

A step forward in submarine salvage has recently been taken by the invention of a system in which an application of well known and well tested mechanical principles to a well understood operating situation. The inventor of this new salvage system is Jesse W. Reno, of New York, a consulting engineer and the inventor of the moving stairway or escalator.

The Reno system consists of a mobile working chamber, or *submarine tractor* fitted for propulsion on the sea bottom by the well known caterpillar tractor belts. In addition to the tractor the system includes a series of multiple-unit open bottom vertical pontoons, submerged to the depth at which the sunken vessel lies, and there securely anchored to the hull and filled with air.

When the sunken ship has been located the tractor, or mechanical "crab," is conveyed to the scene of operations on the deck of a mother ship, or derrick lighter which is anchored over the position of the wreck. Then the tractor which weighs 8 tons on land, is lowered by means of the derrick to the bottom of the sea close to the hull. Two men form the crew of the machine and they enter the tractor through an opening at the top and the cover of this opening is screwed down tight after the men inside. The men are supplied with air by the same system as that used on submarines. This consists in the removal of the carbon dioxygen gas by passing the air through soda lime and the release of the oxygen content from an oxygen tank taken down in the chamber at the time it is lowered. The tractor is seven feet in diameter and nine feet high inside, and when at rests on the sea bottom weighs only eight tons.

The tractor is driven by an electric motor within the chamber and this motor also drives twin boring bars and an external windlass. The current for the motor and the powerful searchlights is supplied through a cable from the mother ship, together with compressed air for filling the pontoons. Telephonic communication is provided through the power cable with no special wires. When the tractor has been lowered to the sea-bottom the search lights are turned on, the tractor belts are set in motion and the "crab" is maneuvered until it is brought into the right position alongside the ship.

The holes into which the pontoon hooks are placed are drilled by means of a combination drill and reamer head on the end of the drive shafts. The head consists of a drill about one and one half inches in diameter, followed up by a reamer which reams the hole to a diameter of five inches. These holes are in sets of four or six with large ships, sets of eight. The sets of holes are located adjacent to the ribs of the ship which divide the groups at their centers. Tests have shown that a pair of holes can be drilled in four and a half minutes.

The operation next to follow is attaching the pontoons, which are made of sheet steel and are closed at the top and open at the bottom. It has been figured out that pontoons twelve feet in diameter and sixty feet long are suitable for most cases, and the number of pontoons required is determined by the size of the ship. A pontoon of this size has a lifting capacity of 200 tons when filled with air. At a point slightly below the center of buoyancy, inside the pontoon, there is welded a circular truss construction which distributes the strain of the lift to all parts of the pontoon. The attaching cables are attached to an equalizing lever, so arranged that equal strain is maintained at all times on each cable, in spite of any uneven, during of the holes, and to compensate for any movement of the pontoons due to wave motion after the ship has been brought to the surface. At the lower end of the cables are standard crane-hooks also mounted pairs on equalizing levers.

Outside the tractor and at its rear is a long winding drum controlling two cables spaced eight feet apart. There is attached to these cables a hollow steel float of enough buoyancy to rise to the surface when released carrying the cables with it. After the required number of holes have been drilled in the hull of the vessel the float is released by the men within the "crab" and the float rises to the surface. The float is fitted at the top with a hook and near the bottom of the pontoon, which is now near the surface of the water, is a staple, whose position is marked by a line of paint running to the top of the pontoon. When the float arrives at the surface a diver secures himself to it and the operators in the tractor are signaled to put the float down. When the diver reaches the staple he inserts the hook and then rises to the surface. The workers in the chamber are now fed and start up the drum motor, they pull the pontoon down to its position of attachment. There is maintained sufficient amount of air in the pontoon during this operation to keep it proper. This is accomplished by means of an electric gauge, which registers the pull of the winding drum in the chamber and in the operating room of the mother ship.

The hooks are inserted in the holes at the ends of the derelict by means of an adjusting rod operated by the men in the chamber. After the hooks are inserted sufficient air is pumped into the pontoon to insure a firm hold to hold it in position while the other pontoons are attached in a similar manner. The pontoons are filled with air by means of a sea-bed syphon, which delivers compressed air from the mother ship to each pontoon in turn. It is obvious that care must be taken in filling the pontoons to maintain an equal distribution of strain and to insure the proper balance of the ship as it rises to the surface.

The Reno system was given a practical test this spring when preparations were made to raise the Coast Guard Cutter *Seneca*, formerly one of the Eagle boats, which lies in 60 feet of water in Long Island Sound, off Whitestone Landing, L. I. The vessel is 200 feet long, 25 foot beam and 18 feet molded depth, with a displacement rating in commission of 500 tons. Eight pontoons, each measuring 12 feet in diameter and 25 feet long, were to be fastened to the sides of the sunken vessel. There were four pontoons to each side and each pontoon had a lifting capacity of 100 tons. Six pontoons had been attached to the ship and filled with air. The outer two had been attached and the work of pumping air into them had begun. Then suddenly three pontoons, one following the other at a few minutes intervals, jerked loose from the vessel and shot up into the air.

Mr. Reno explained to the writer that the plates of the vessel were too weak to hold the strain and hence gave way for the three pontoons. The plates on the *Seneca* are only 3/8 of an inch in thickness.

However it is only a matter of working out details for securing a stronger hold on the vessel with the lifting hooks and when that is accomplished Mr. Reno hopes to raise the vessel. At the time of this writing work is progressing again on the Eagle boat and it may be that when this article appears in print that announcement will have been made that the ship has been floated.

All parts of the Reno salvaging system operated just as the inventor had planned. The "crab" crawled over the sea bottom along the sides of the ship, to get in position when the holes were drilled, the pontoons were attached as planned for. The latter were fixed in their proper position, and had not the plates given way for the three pontoons, the chances are that the ship would have been raised. This experiment will no doubt be watched with interest on the part of those who hope to recover the treasures hidden in the ocean depths. It is claimed that this system can be used on hulls resting at depths of 500 feet.

## Extraordinary Tesla Experiments

## Interesting Articles in July Issue Practical Electrics

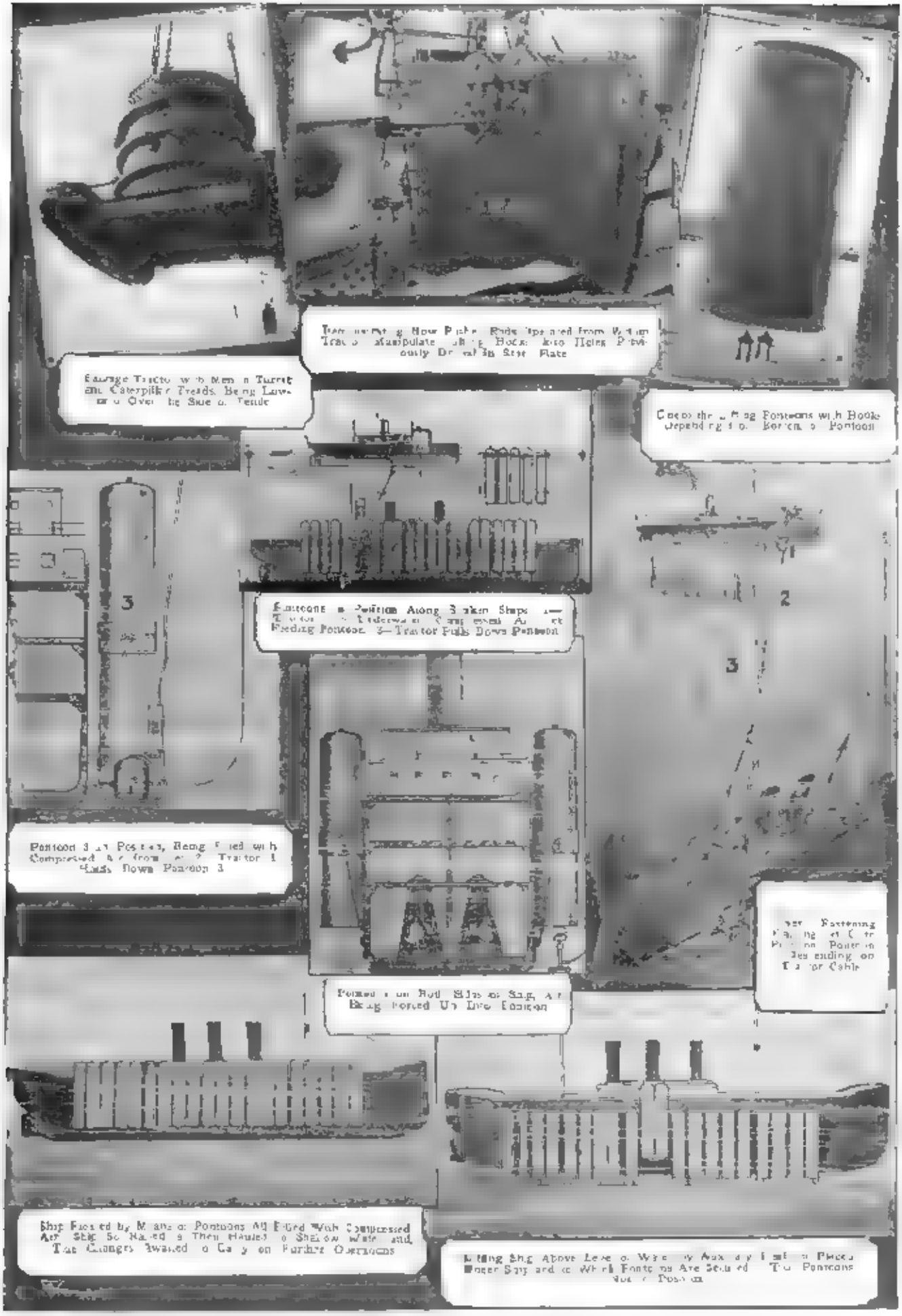
ELECTRIC FOUNTAIN OF YOUTH
By Clyde J. Fitch

FORD COIL BUZZER
MY W[illegible] BE[illegible]

[illegible]

ELECTRIC THREAD GAUGE
REPAIRMAN'S TEST PANEL
DETERMINING MOISTURE
By George G. McVicker

TOY MOTORS
SENDING PICTURES BY WIRE
HIGH TENSION DISCHARGE PHENOMENA By Earl N. Ho
FARMER ELECTRIC RAILROAD


Tractor with Main Turret and Caterpillar Treads Being Lowered Over Side of Vessel
Pontoons in Position Along Broken Ships
Pontoon 3 in Position, Being Filled with Compressed Air from Vessel
Pontoon 3 Pulls Down Pontoon 3
Ship Floated by Means of Pontoons All Filled With Compressed Air
Lifting Ship Above Level of Water by Auxiliary Pontoons Placed Under Ship and to Which Pontoons Are Secured

# ASTRONOMY NUMBER

Sept.

# Science and Invention

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ELECTRICITY

## TOTAL ECLIPSE OF THE SUN SEPT. 10th

See Page 450

## IN THIS ISSUE

*Articles by*

Prof. William H. Pickering, Ph.D., L.L.D.
of the Harvard Observatory

Isabel M. Lewis, M.A.
of the U. S. Naval Observatory

Professor Vladimir Karapetoff

Professor Harold F. Richards, Ph.D.

E. E. "Farmer" Dunn

Clement Fezandié

Dr. Ernest Bade

Professor Joseph Dunninger

Ray Cummings

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View of the Gigantic Machine Designed by Dr. Hackensaw for Projecting His Moon Car on Its Journey Away From the Earth. The Passengers Are Placed in the Car Itself, and As the Huge Wheel Is Rotated by a Giant Electric Motor the Chain Is Fed Into the Hub of the Wheel and Causes the Radius of the Swing to Be Increased. When the Velocity of the Car Has Reached a Certain Point, It Is Suddenly Released and Leaves the Earth.

# Doctor Hackensaw's Secrets

## By CLEMENT FEZANDIÉ

*(Author's Note. Will man ever be able to travel to the moon or to the nearest planets? The problem is one of perennial interest, and many fiction writers have attempted to solve it. Numerous fantastic schemes have been proposed, but I have endeavored to show in the following story that the sending of a passenger to the moon is by no means an impossibility)*

## No 20
## A Car for the Moon!

"DOCTOR," said Silas Rockett, "Did I understand you to say that you intended to send a car to the moon?"

"You certainly did, Silas," replied Doctor Hackensaw. "The moon was in a condition to support life hundreds of thousands of years before the Earth. Hence there may be intelligent creatures on the moon with inventions far in advance of our wildest speculations. Think what it would mean to open communication with them and learning what it would otherwise take us a hundred thousand years or more to learn! It would be a triumph such as no man has ever achieved before me!"

"I understand that," said Silas, "but what I don't see, is how you are going to send your car of specimens to the moon. Many fiction writers have tackled the problem of communication with other worlds, but I confess that none of the methods I have read about seems to me to have any scientific basis. But tell me first, straight out, whether you really believe it is possible, at the present day, to send a car of any sort to the moon?"

"Not only do I believe it possible, Silas," replied Doctor Hackensaw, "but my conviction is so strong that for the past few years I have been secretly at work on the preparation necessary for sending a car full of specimens to the moon."

"What!" cried Silas in amazement. "You have already started making preparations for the trip? Is it possible that you have discovered some new force, some new means of locomotion?"

"No, Silas. The forces I shall use are all well known."

"But how in the world will you accomplish it? None of the schemes I have read about seems to offer the slightest possibility of being put into practice."

"What schemes have you read of?"

### SILAS AND THE DOCTOR DISCUSS VARIOUS SCHEMES

"First of all there was the idea of being carried to the moon by birds. If I remember correctly, it was Cyrano de Bergerac who made the journey in that way. Such a method is of course impossible."

"True. No bird could fly to the moon. I'll admit that."

"Next Edgar Allan Poe sent Hans Pfaal to the moon in a balloon. That, too, was impossible."

"I am ready to admit that also. Understand me; I am not a believer in the *ether* theory of light. Consequently I do not believe the heavens are filled with the so-called 'ether.' Nor do I believe there is an actual vacuum in space. My idea would be rather that there is a highly rarefied atmosphere between us and the planets. But, regardless of the question as

(*Continued on page 502*)



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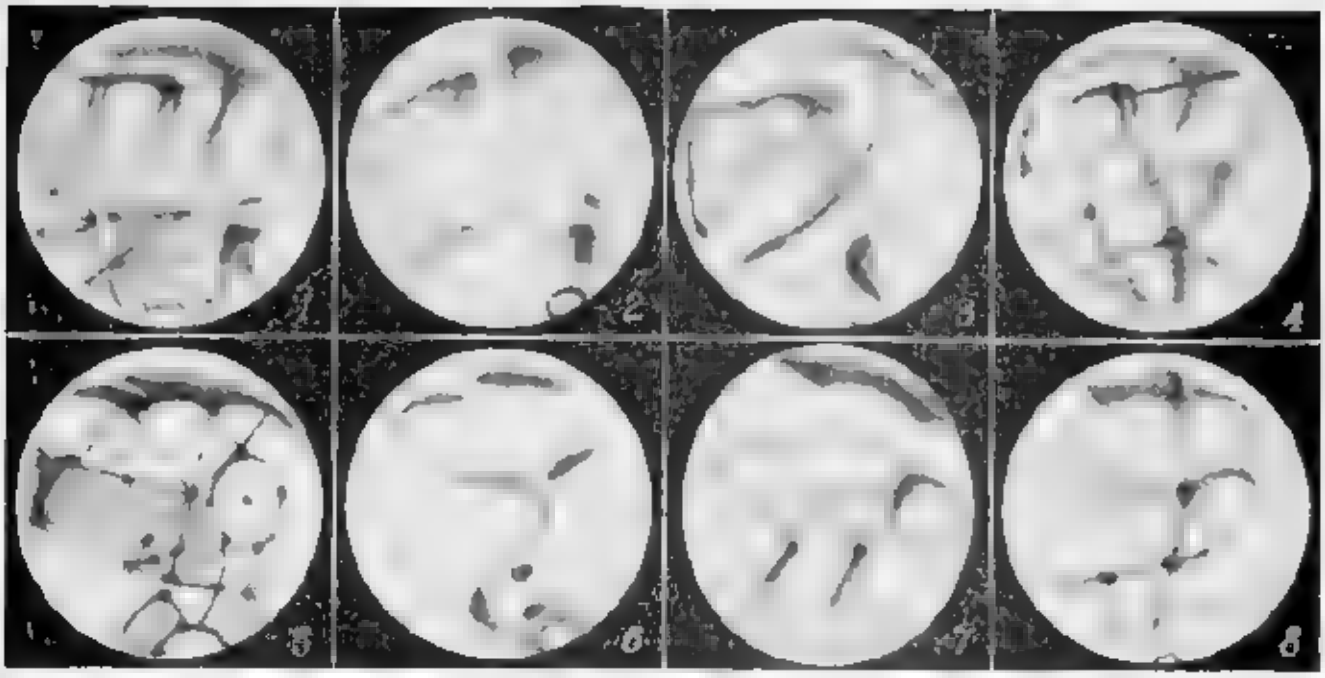

The Planet Mars As It Appears Through the Telescope When Viewed By the Observer. These Are Not Photographs of the Planet Mars Showing the Canals. For the Reason That It Is Almost Impossible to Secure Good Photographs of the Very Fine Detail. The Work of the Planet's Surface. The Reason Is Due To the Earth's Atmosphere Which Tends To Blur the Fine Spider Web Structure That Covers the Face of Mars. We Show Drawings Made By Different Observers. These Drawings Were Made on a Night When the Seeing Was Good. The Drawings Are Considered Perfectly Authentic Made By Observers Thousands of Miles Apart. The Planet Mars and These Canals Are Not Artificial But Can Be Explained By Natural Means

# The Planet Mars

## By Prof. WILLIAM H. PICKERING

HARVARD COLLEGE OBSERVATORY, MANDEVILLE, JAMAICA, B. W. I.

The year on Mars is nearly twice as long as this year. It will be of great interest to observe Mars next year, as we are then approaching it at a period of its orbit more than usually favorable for observation. Since the planet's orbit is quite eccentric, we occasionally pass comparatively near to it, that is to say within 35,000,000 miles, which seems near in astronomical distances. This will happen on August 22d of next year, when Mars will appear nearly as bright as it has been for over 120 years. Not until we be as near again during the present century. The planet will then appear even brighter than it does now, as the earth will be on the same side of the sun as Mars, instead of on the opposite side, as it is this year. It will also be seen at a far more favorable altitude, which is much more important. We therefore hope to secure many interesting observations then. The season on Mars will be the middle of November for its northern hemisphere or late spring for its southern. The south pole of the planet will therefore be turned towards the Earth, and we shall be able to study the whole of the southern hemisphere to great advantage.

The drawings illustrating this article were made in 1920, when the northern hemisphere was presented to us, and they show that hemisphere very clearly. Like all planetary drawings, north is placed at the bottom of the picture, and the northern snow cap is distinctly shown in each of them, thus locating the pole of the planet. The Martian month was late July and early August (though most of the drawings were made in April and May). At that time the Earth was once and a half as far from Mars as we shall be next year.

### HOW MAPS OF MARS WERE MADE

These drawings were all made by expert observers belonging to the International Society for the Study of Mars. This society includes many of the most prominent of the amateur astronomers throughout the world. Under each original drawing is the name of the observer and the longitude of the planet's central meridian at the time the drawing was made. Referring to the drawings individually, it may be stated that Dr. Maggini believes that he sees everything that he sees, or things that resemble them. Some of this detail is so small that in order to show it at all he has to greatly exaggerate it. It is not unlikely that many of these details are for this reason really double lines on the planet, but are marked analogously to a map. The other observers insist on drawing only those things of which they are absolutely sure, feeling that it is better to omit some real detail than to draw something else that is not there.

**WILLIAM HENRY PICKERING is one of the best known astronomers in the world today. He is an expert on the subject of Mars, and we are sure that our readers will enjoy this specially written article by Professor Pickering. He is a Fellow of the American Academy, a member of numerous astronomical societies, and he holds the order of the Chevalier Saint James of Portugal. We are fortunate indeed in having procured this timely and exceptional article for SCIENCE AND INVENTION, by so prominent and brilliant an investigator of stellar mysteries.—EDITOR**

### SEASONAL CONDITIONS ON MARS

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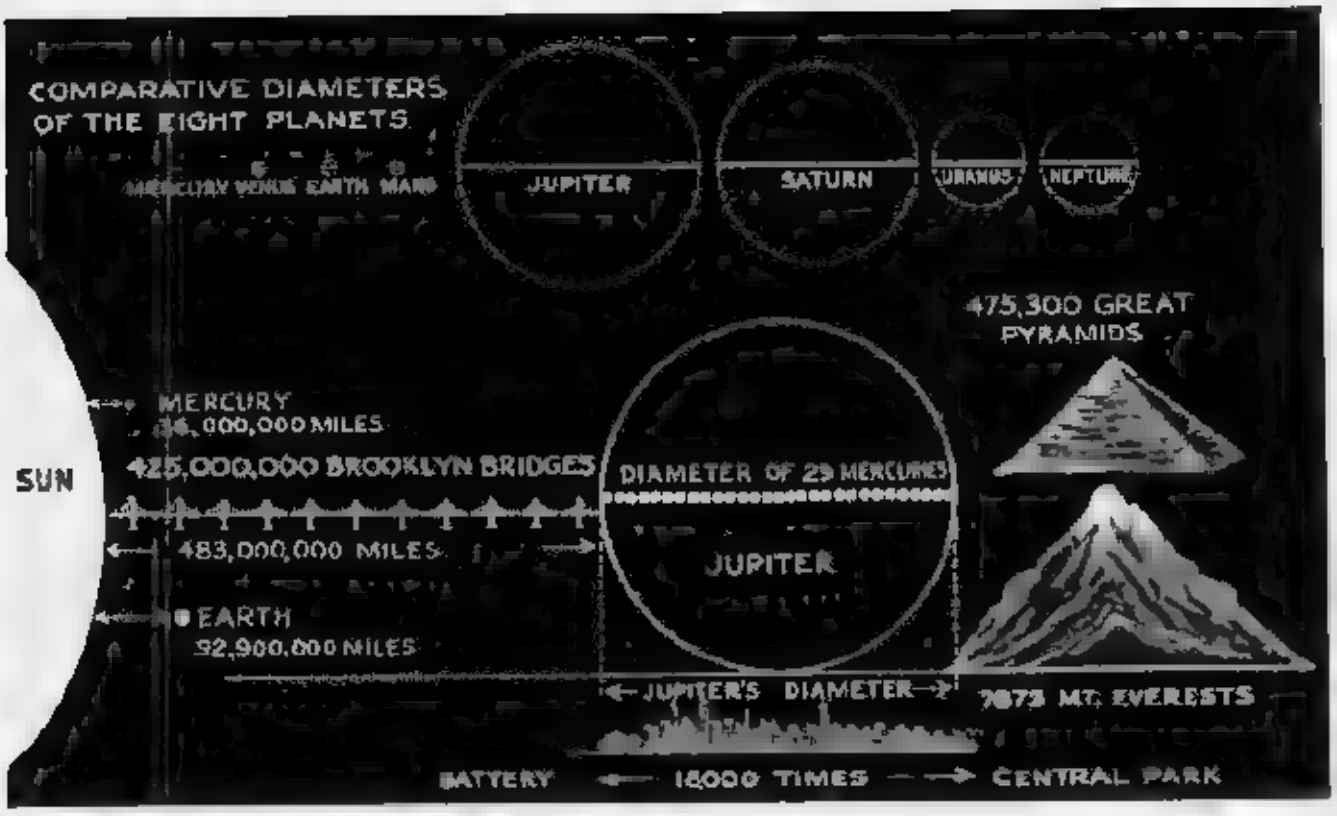


**The Chart Above Shows In a Striking Manner the Comparative Sizes of the Eight Planets Constituting the Solar System. Mercury Is the Smallest of the Planets, While Jupiter Is the Largest, Having a Diameter Equivalent to Twenty-nine Mercuries. Jupiter's Diameter Is 18,000 Times the Distance From the Battery in Central Park, N. Y. C., and It Will Need Over 400 Million Brooklyn Bridges to Bridge the Gap Between Jupiter and the Sun**

# The Largest and the Smallest Planets

## By CHARLES NEVERS HOLMES

EIGHT planets constitute the planetary membership of our Solar System. Of course these planets are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune. There may exist other planets, besides these eight, but astronomers have not as yet discovered a ninth planet. In order of respective size these eight planets are Jupiter, Saturn, Neptune, Uranus, Earth, Venus, Mars and Mercury.

Accordingly the largest planet of our Solar System is Jupiter, the smallest is Mercury. Both Jupiter and Mercury vary in their distances from the Sun and from our Earth. Jupiter revolves at a mean distance of 483,000,000 miles from the Sun, it may approach as near as 370,000,000 miles to our World or recede as far as 600,000,000 miles from us. Its mean distance from the Sun is, therefore, not quite 1/5th that of Neptune, the farthest planet from our Sun. Mercury is not only the smallest of the eight planets but it is also the nearest to the Sun. It revolves at a mean distance of 36,000,000 miles from the Sun, and its distance to our Earth varies from 50,000,000 to 136,000,000 miles. At its nearest distance to us Mercury approximates 1/7th of Jupiter's nearest distance to us.

The "year" of the planet Jupiter is almost twelve times as long as our Earth's. The "year" of Mercury only about 1/4th that of the World's. As we well know our Earth's year is approximately 365¼ days of length. The reason for Jupiter's longer year and Mercury's shorter year is owing to Jupiter's longer orbit and Mercury's shorter orbit around the Sun and to their relative speeds. Around our Sun, the latter planet speeds with a velocity of 23 to 35 miles per second, the former planet with a velocity of only 8 miles per second.

The density or solidity of Jupiter is estimated to be even a little less than that of our Sun. There have been a number of estimates respecting the density of Mercury. Whereas Jupiter's solidity approximates only about one-quarter that of our Earth, Mercury's density has been estimated from 85,100ths of the terrestrial density to a density comparable with our Earth's. Now our Moon is almost 2/3rds as solid as our Earth. In other words, our Earth's density is about 5½ times that of water. Jupiter's density a little greater than that of water, whilst Mercury's has been estimated, upwards, from 4 7/10ths times the density of water.

All the eight planets vary respecting the so-called weight of bodies at their surfaces. The weight of a body on the planet Jupiter is about 2 65/100ths times the weight of such a body were it weighed upon our Earth's surface. That is one of us who weighs 150 pounds here, would, were he transported to Jupiter's surface, weigh almost 400 pounds. Of course, Mercury is smaller than either Jupiter or our World, so that we should expect a 150-pound body to weigh less there than what it would on either of the other planets. A good estimate would perhaps be about 60 pounds. Compared with these respective weights, a 150-pound body would weigh about 25 pounds on the Moon and more than 2 tons on our Sun. These calculations leave centrifugal force out of consideration.

There are many other interesting facts about the largest planet and the smallest planet of our Solar System. We know that it takes our own Planet about 24 hours to rotate once around its axis. Now, Mercury takes about 88 days to complete one of its axial rotations, and Jupiter only about 10 hours. That is to say the planet Jupiter rotates more swiftly around its axis than any of the 7 other planets. Respecting moons or satellites: Mercury possesses no known moon, whereas Jupiter has 9 known moons revolving around it. One of Jupiter's moons, Ganymede is larger than the planet Mercury and another one, Callisto, is almost as big as Mercury.

And, now how large is the largest planet in our Solar System and how small is the smallest planet?

The diameter of Jupiter is more than 86,500 miles, our Earth's diameter being about 7,918 miles. Accordingly, Jupiter's circumference is more than 10 times that of the earth, and the giant planet's volume is over 1,309 times greater than our own planet's volume. With respect to some of the other planets, Jupiter is about 1 7/10ths times as large as Saturn and nearly 9,000 times as large as Mars and approximates the volume of 24,000 Mercuries, combined in one planet. It is 64,000 times as large as our moon.

As for the planet Mercury, its diameter is about 3,000 miles, or nearly 39.100ths the diameter of our World. Accordingly this pigmy planet's volume is only about 1/18th of our Earth's volume. The planet Saturn is some 14,000 times as large as Mercury, and the planet Mars almost 3 times as big. Mercury is larger than our Moon, but only 2 3/4ths times as large.



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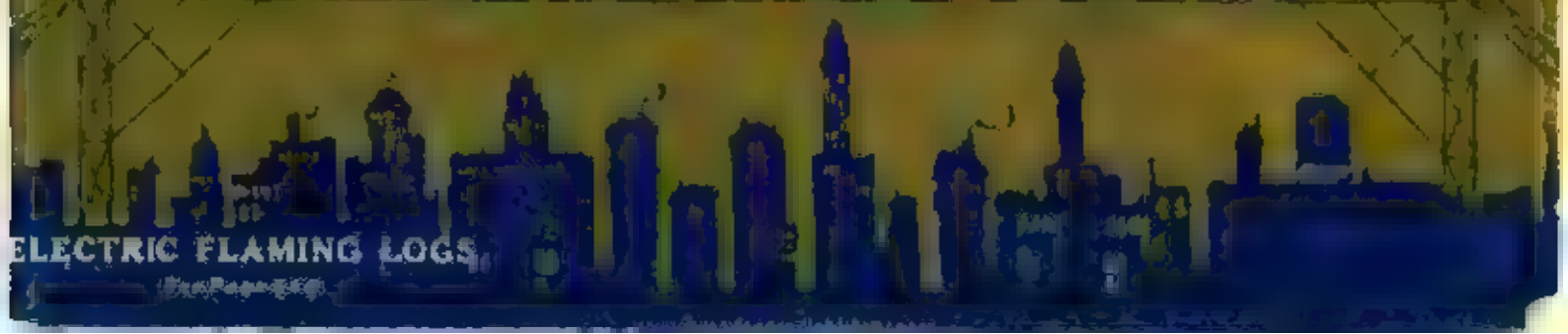
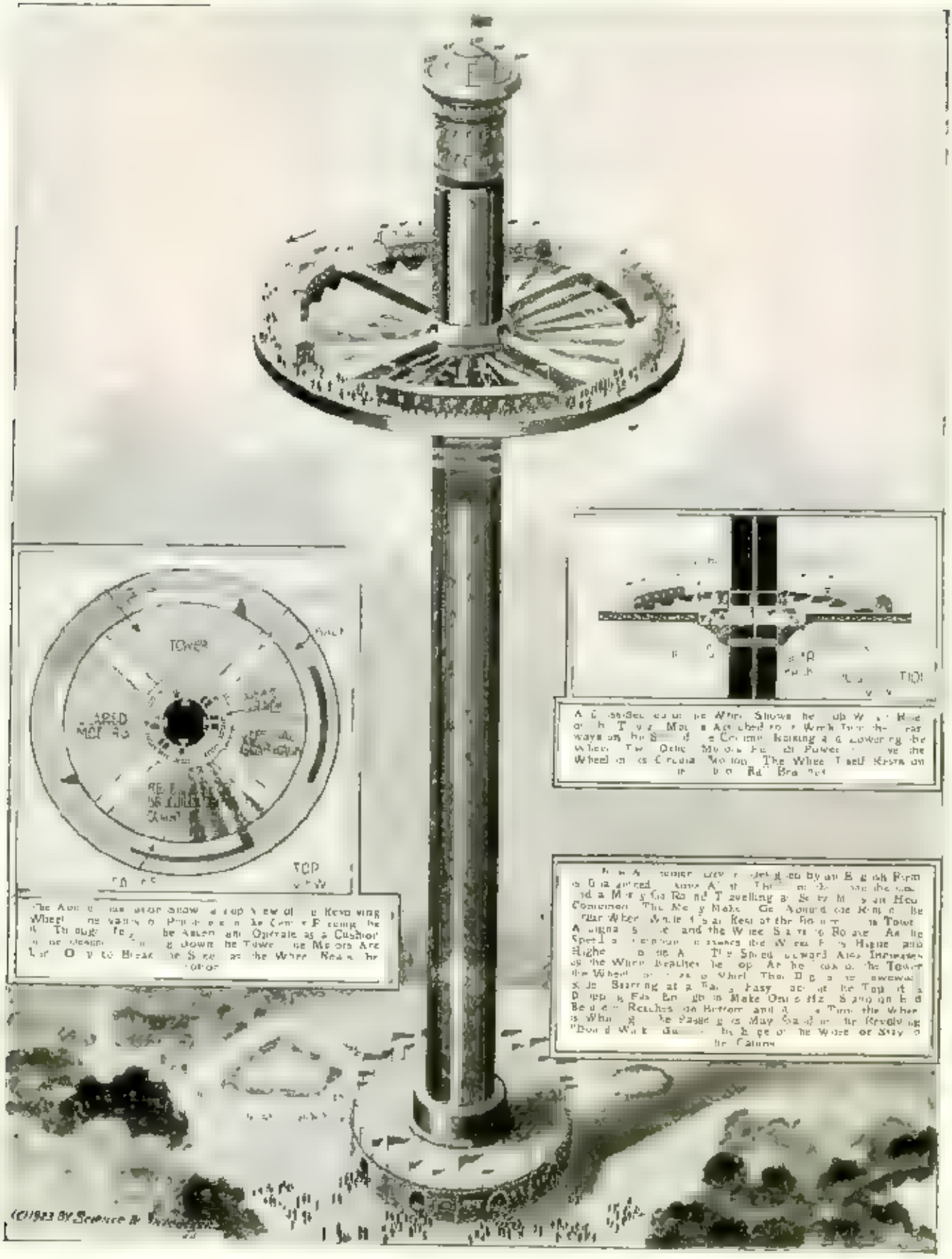


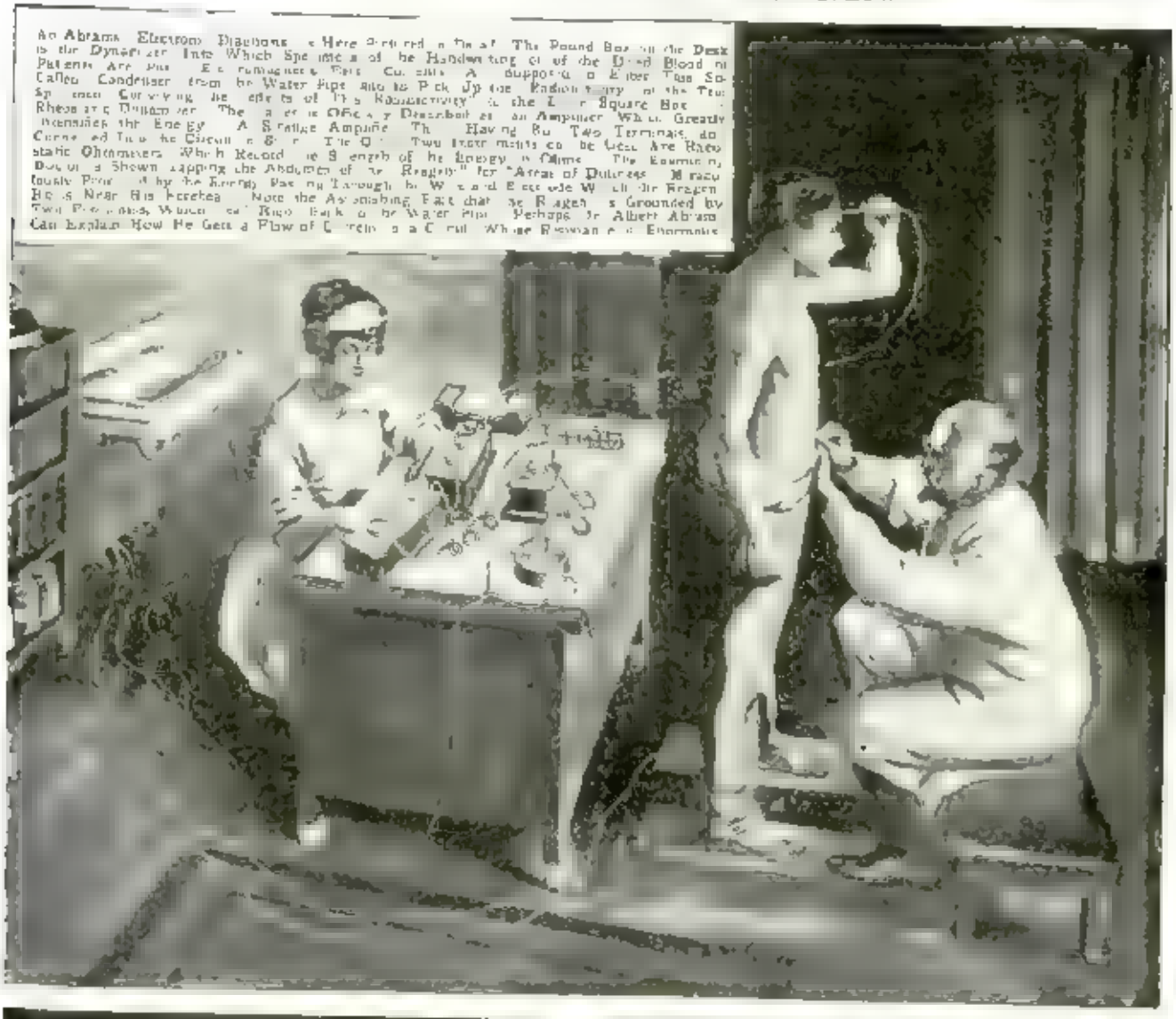
# A Whirl of Merriment



# A Modern Charlatan

## By A. B. TRIPP

**WE HAVE HAD MANY LETTERS FROM OUR READERS REGARDING DR ABRAMS SUPPOSED ELECTRONIC CURES. WE GIVE OUR OPINION BELOW**



An Abrams Electronic Diagnosis Is Here Rendered in the Air. The Round Box on the Desk is the Dynamizer Into Which Specimens of the Handwriting or of the Dried Blood of Patients Are Put. Electromagnetic Rays Coming From A Supposed Ether Tube Sometimes Called Condenser from the Water Pipe Are to Pick Up the Radioactivity of the Specimen Conveying the effects of This Radioactivity to the Lower Square Box Which is the Rheostatic Dynamizer. The Large Object is Officially Described as an Amplifier Which Greatly Increases the Energy. A Similar Amplifier Is Having Its Two Terminals Connected Into the Circuit at Either Side. Two Instruments can be Seen Are Rheostatic Ohmmeters Which Record the Strength of the Energy in Ohms. The Examining Doctor is Shown Tapping the Abdomen of the Patient for "Areas of Dullness" Usually Present Due to the Energy Passing Through to Where Electricity Is Not Wanted. Note the Astonishing Fact that the Patient is Grounded by Two Pipe Leads, Which Run Back to the Water Pipe. Perhaps Dr Albert Abrams Can Explain How He Gets a Flow of Current in a Circuit Whose Resistance is Enormous

**The 'Oscillo ant.' Above—Abrams' Cure-all Treating Machine Pictured Beside a Wornout Set of Gas Cell Plates. Below—Ash Heap Where So Certain That It Would Scarcely Run a Doorbell for More Than Two or Three Seconds, Yet This Old Burnt Out Running In Order' Was a Very Hercules of Power as a Generator of Electronic Oscillations When Compared with the Grounded Electric Buzzer Hovering Immediately Above It. The Only Energy That the Oscilloclast Generates is Sound Noise Small Center Picture Shows How Abrams 'Short circuits' the Brain. "Brain Waves May Be Conducted Through Wires. Says Dr Abrams**

An Ordinary Piece of Wire Clipped to Hair on Opposite Sides of the Head Will Show Brain Waves. Page 20. New Conception of Diagnosis and Treatment by Dr. Albert Abrams. Aiding a Closeup View of the Dynamizer Instruments. A—The Wonderful Little Dynamizer" Which Abrams Pretends is a 'Condenser' B The Dynamizer Cap or Lead After the Cover Electrode Has Been Removed. Note the Two Aluminum Electrodes Inside Upon Which the Weighed up Blood Specimen is Placed. C—A Brow Electrode with Rubber Ring to Prevent Metal Contact with the Skin D—The Abrams Rheostatic Dynamizer



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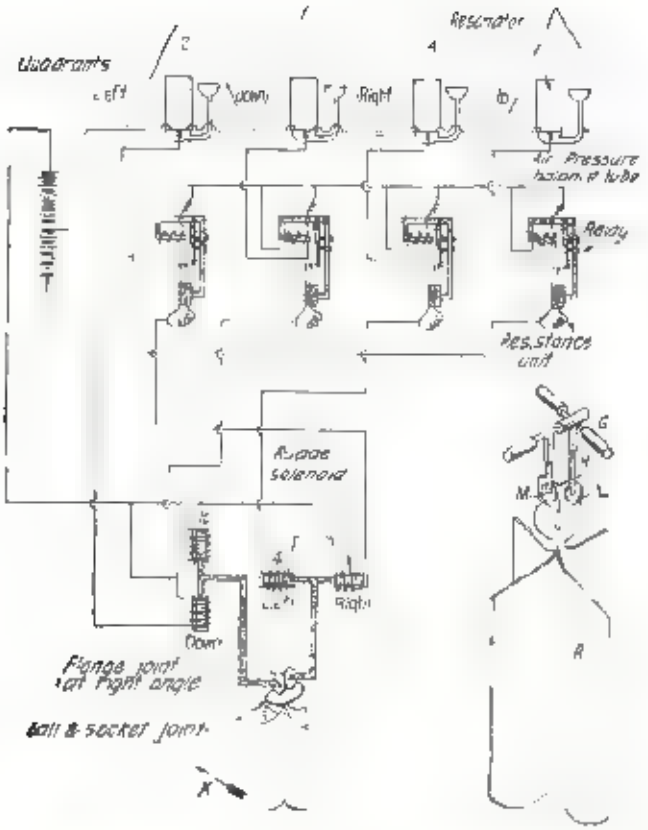


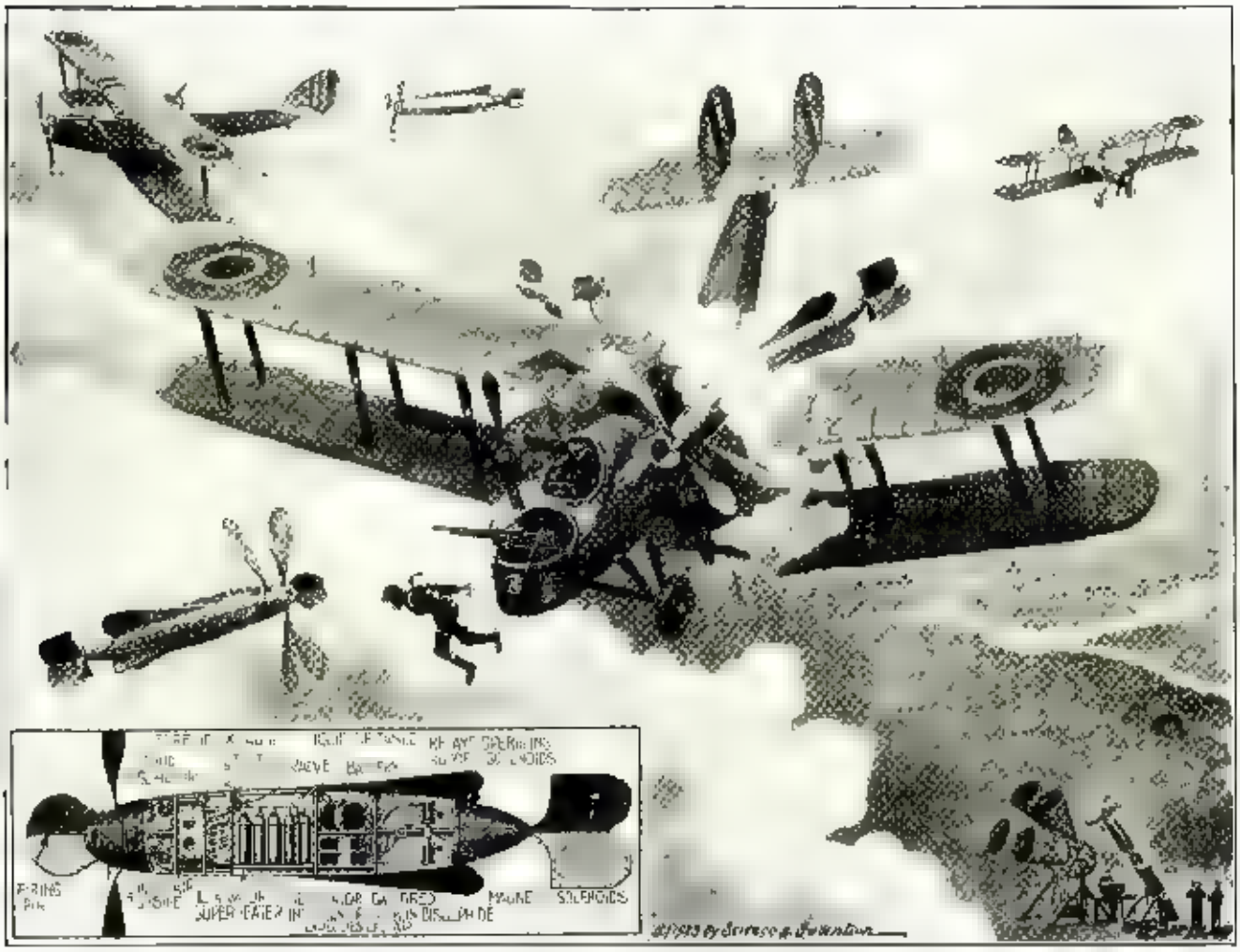

# Sound Of 'Plane Attracts Aerial Torpedo

## By RAYMOND F. YATES

This New Aerial Torpedo Which Follows the Trail of An Airplane As Tenaciously As Does the Proverbial Bull Dog On the Trail of the Unhappy Tramp, Is the Invention of D. Sidney Morton Baruch. The Electrical Circuits Shown in Schematic Form at the Left Serve to Show How the Various Resonators or Sound Detectors, Mounted in the Nose of the Aerial Torpedo Act On Magnetic Relays Which Open and Close the Circuits to the Magnetic Solenoids Controlling the Steering Rudders of the Device

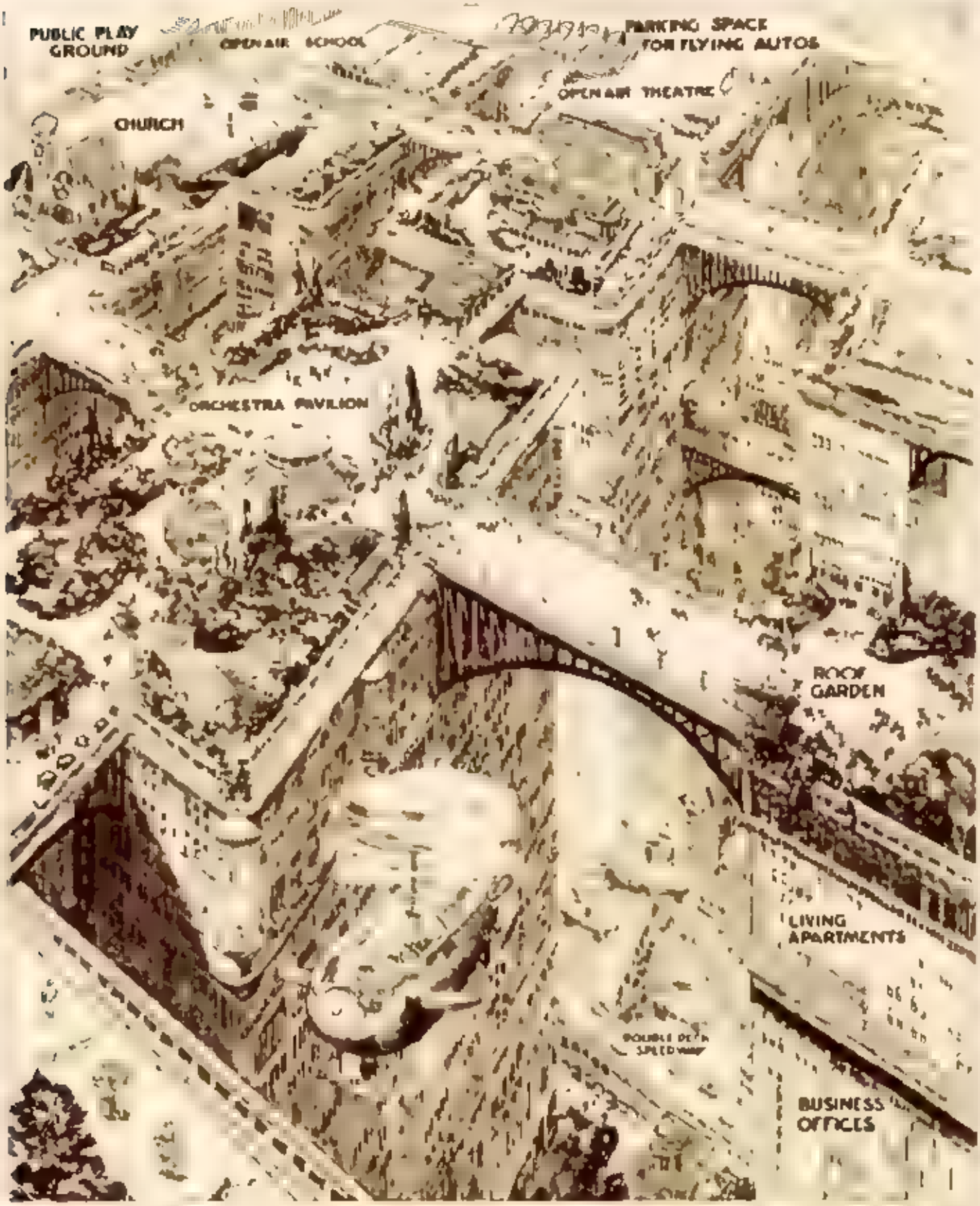
The Aerial Battle Scene Shown Below in Full Activity Makes Clear Just How the Sound Attracted Aerial Torpedoes Once They Have Been Shot From the Earth. Follow the Plane With Deadly Accuracy. The Large Horns Shown in the Lower Right-Hand Corner Serve to Collect the Sound From An Airplane Toward Which They Are Trained, and the Pitch of This Sound Is Accurately and Quickly Measured. The Sound Resonators in the Aerial Torpedo to Be Fired at the Plane Are Then Tuned to the Particular Sound of the Craft to be Attacked—and Away It Goes On Its Winged Mission of Destruction. Every Airplane Has a Different Sound so That the Feasibility of this Scheme Seems Well Substantiated.

The Detailed Drawing, Lower Left Hand Drawing, of the Baruch "Blood-Hound of the Air" Shows the Liquid Air Storage Tanks and Super-Heater Together With Liquid Air Turbine for Propelling the Torpedo, as Well as the Electro-Magnetically Controlled Rudders Actuated by Microphones Attached to the Sound Resonators. If the Sound is Strongest from Below Then the Rudders Are Turned so as to Cause the Torpedo to Go in That Direction, and Vice Versa.



# Our Cities of The Future

## By H. GERNSBACK

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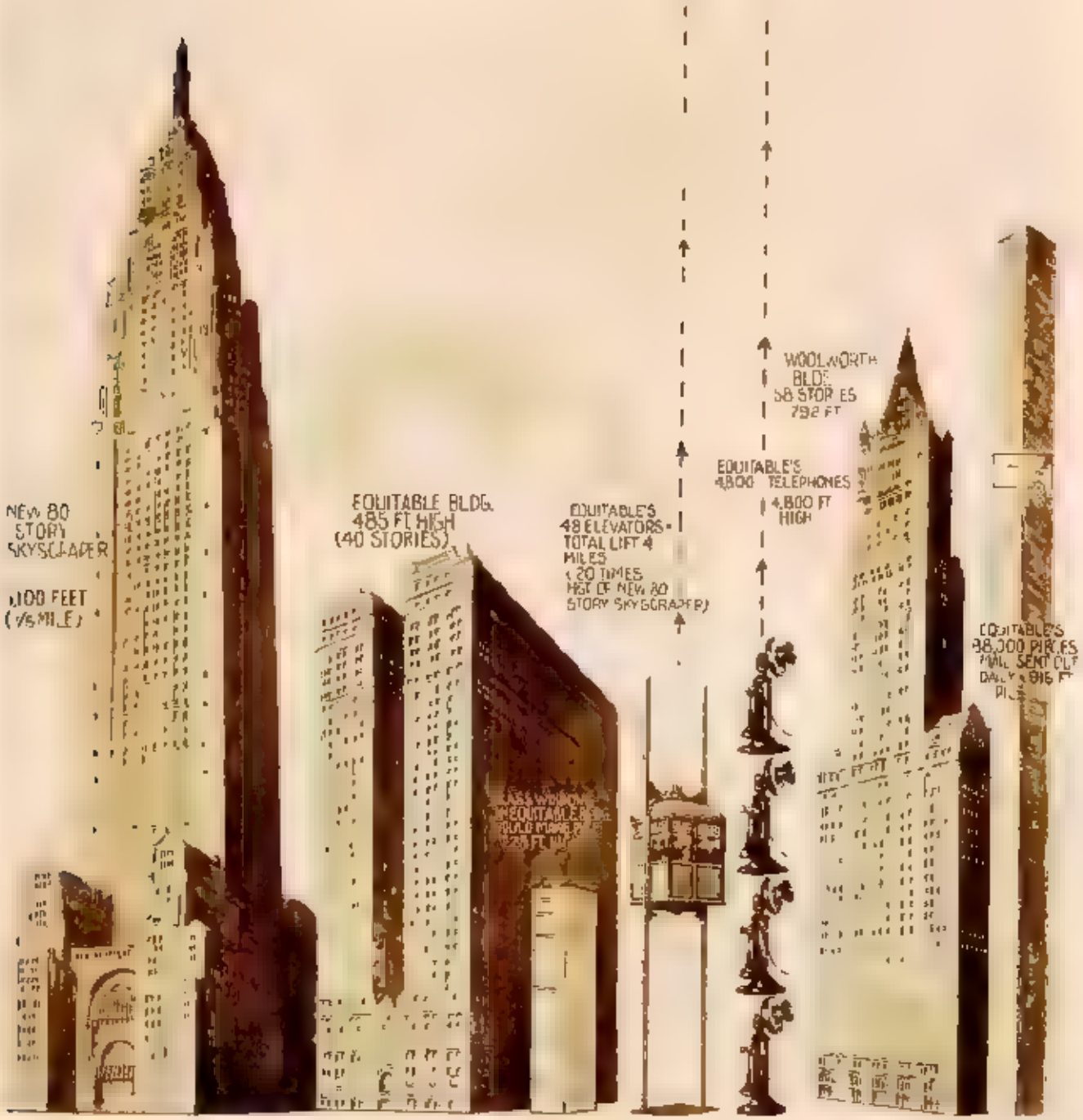
In Europe, as a Rule, People Do Not Travel To and From Business Taking Hours Minutes Just How Long It Is Going To Already They Have Near Their Place of Business and Home Most of Them The Illustration Shows an American City of the Future Which Will Be Away with Its Present Traveling Which Nearly All Of Us Do Today At Present This Takes Many a Hard Hour of Time Motor Car Ferry on Top Connecting In the Future the Cities Will Be Laid Out with Business Buildings Covering Entire Blocks as Shown Above Also There Will Be Apartments Where People Will Live The Public Restaurant and Landing Place for Air Ships Will Be on Top of the Apartments The Top Level Will Be Connected by Bridges The Advantage This Plan Is Obvious Getting the Air Has Not Been Touched as Yet as a Large Scale To Be Sure in New York There Is an Indoor Roof Garden Upon Which Even Large Trees Grow

# Sky-Scraper To Tower 80 Stories



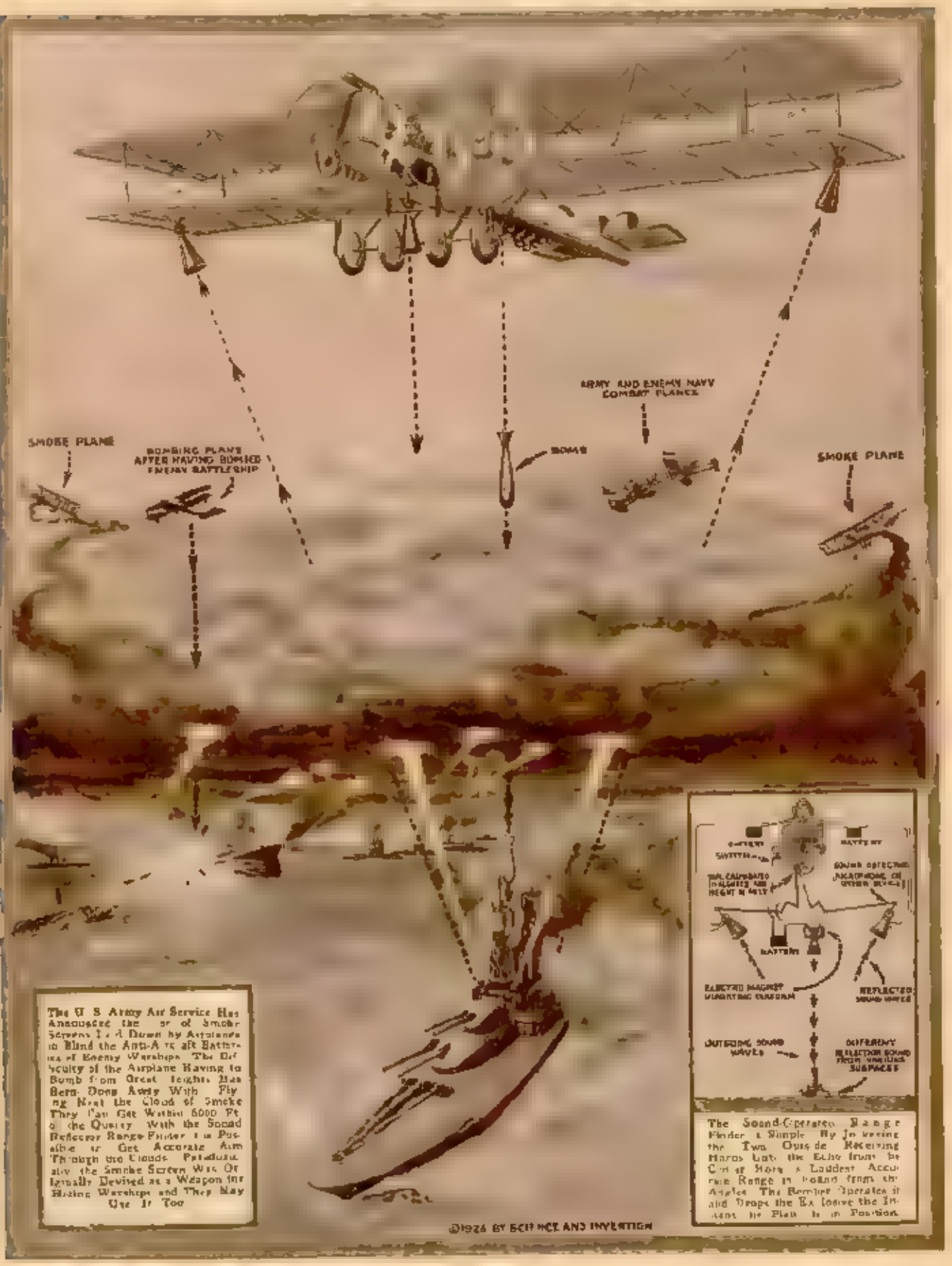

With the Announcement of Plans, Drawn by Bertram Grosvenor Goodhue, for the Erection of an Eighty-Story Office Building to be Built on the Site of Madison Square Garden, New York, Some of the Problems of Caring for Such a Building After Construction Are Illustrated Here. When Built, the Tall Central Tower Will Reach 1,400 Feet Into the Air, Nearly a Fifth of a Mile Above the Street Level. It Will, of Course, be the Largest Office Building in the World.

The Illustration Shows It Compared with the Two Other Large Buildings, The Woolworth and the Equitable. Each Day 38,000 Pieces of Mail Fall Through the Chutes That Run From the Top to the Bottom Floors of the Equitable Building. Were They Stacked in One Huge Pile, the Resulting Stack Would Tower 916 Feet Into the Air, or 124 Feet Higher Than the Woolworth Tower. The 14,000 People Who Daily Earn Their Bread in the Equitable Building Talk Over 4,800 Feet of Telephones. That is They Would if the Telephones Were Stacked. The Ordinary Desk Instrument is just a Foot Tall.

There Will Have to be Quite a Few Elevators in the New Skyscraper, Too. Every Time the Forty-eight Elevators of the Equitable Building Make a Complete Trip They Rise a Total Distance of Four Miles. More than 90,000 People Use These Cars Every Day. The Equitable Still Remains the Largest Office Building in That It Houses the Greatest Number of Persons.

The Glass in Its Windows, if Stacked, Would Reach a Height of 228 Feet. Ten Men Wash Them But They Never Get Through Before They Get Clear Around the First Ones Are Ready for Another Bath. The Foundations Upon Which the New Building Must Rest Will Need a Great Deal of Attention. The Equitable Foundations Go Ninety Feet Below the Surface of the Street and the Piles That Hold the Woolworth Tower Are Sunk 110 Feet Into the Ground.

# Smoke to Hide Bombing Planes

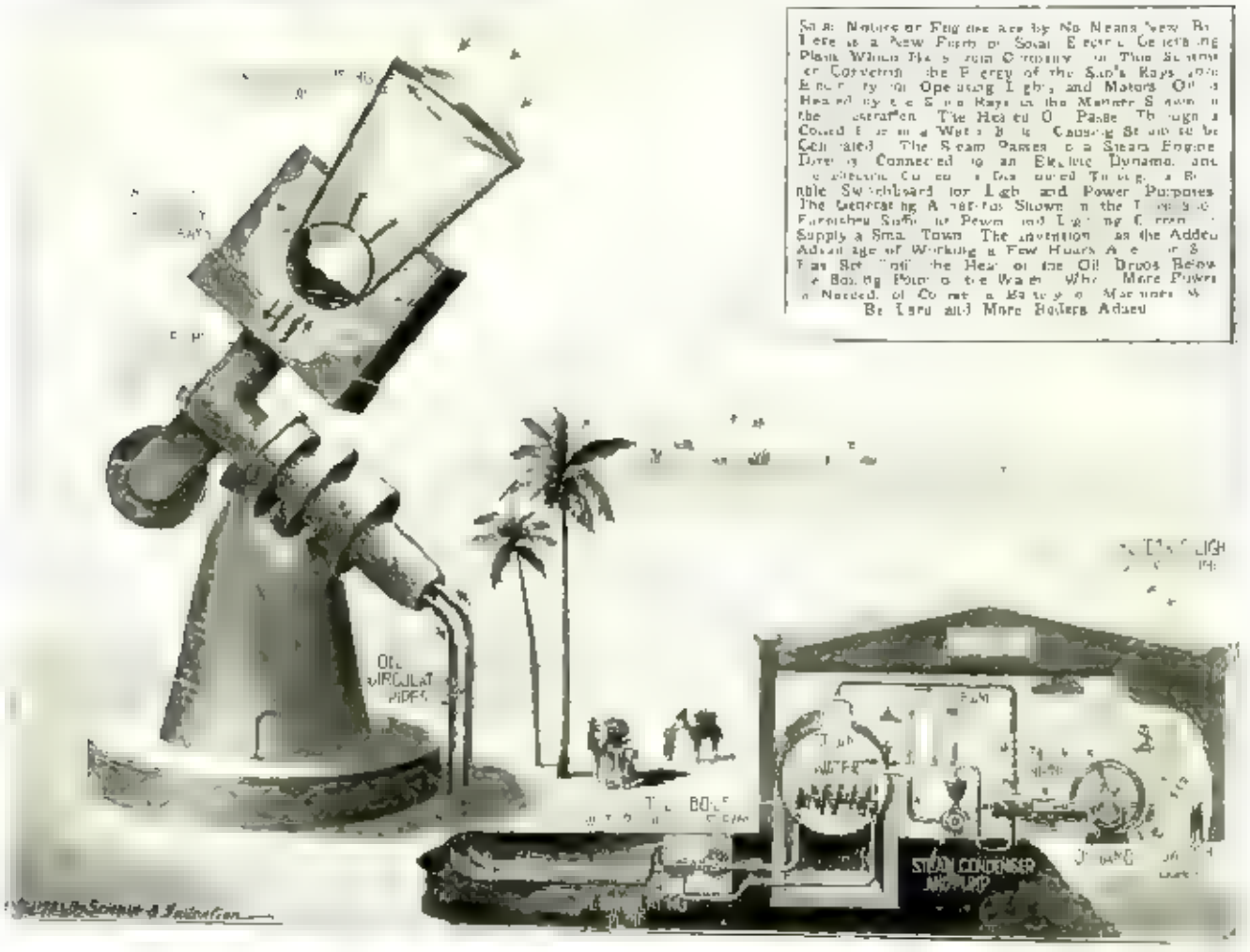



The U. S. Army Air Service Has Announced the Use of Smoke Screens Laid Down by Airplanes to Blind the Anti-Aircraft Batteries of Enemy Warships. The Difficulty of the Airplane Having to Bomb from Great Heights Has Been Done Away With. Flying Near the Cloud of Smoke They Can Get Within 6000 Ft. of the Quarry. With the Sound Reflector Range-Finder It is Possible to Get Accurate Aim Through the Clouds. Paradoxically the Smoke Screen Was Originally Devised as a Weapon for Hiding Warships and They May Use It Too

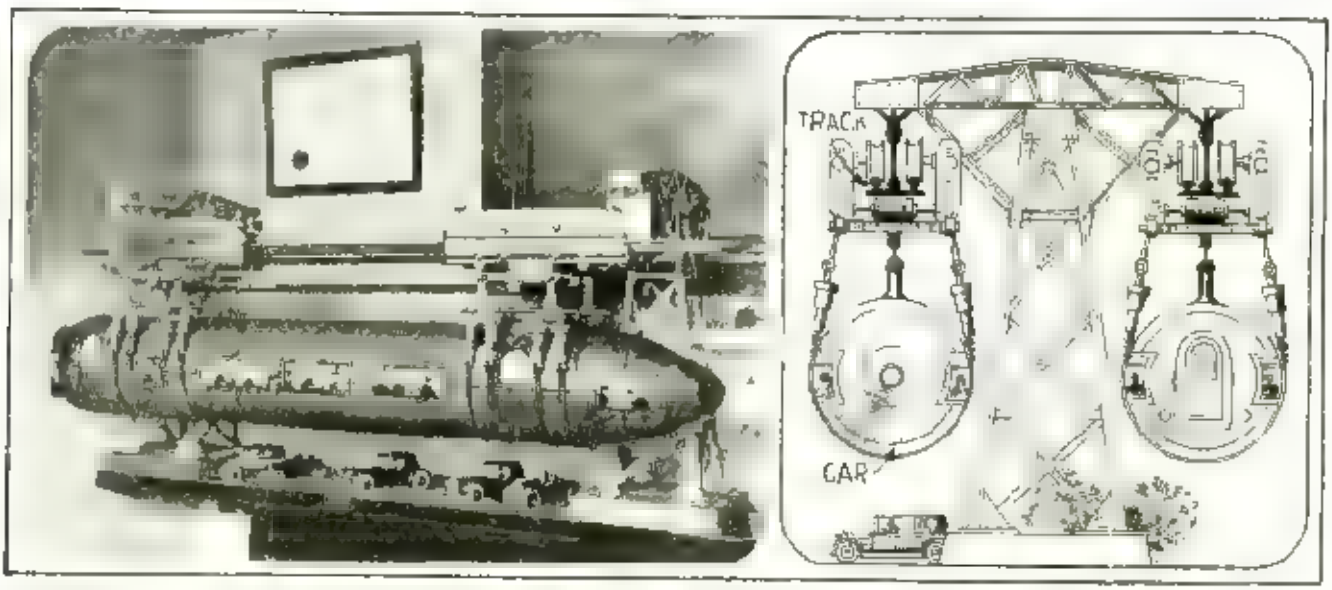
The Sound-Operated Range Finder a Simple Affair Having the Two Outside Receiving Horns Unit the Echo from the Crest of Many a Loudest Accurate Range is Found from the Angles. The Bomber Operates it and Drops the Ex losive the Instant the Plane is in Position

# Electricity From the Sun

By Dr. H. BECHEF




# New Suspended Electric Railway



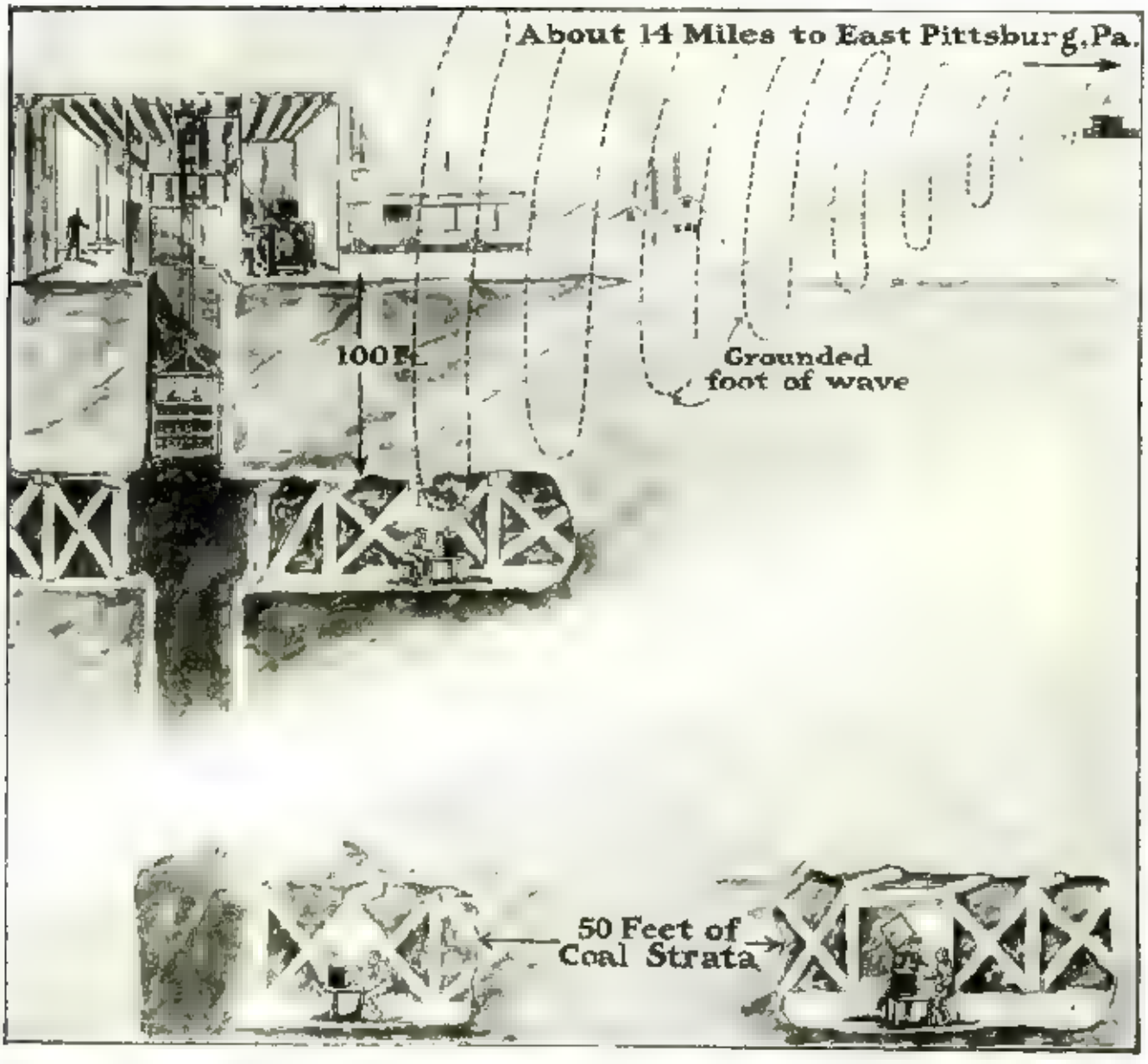



www.americanhistory.com

# RADIO DEPARTMENT

## How Radio Will Aid Mine Rescue

By W. E. ARVIN



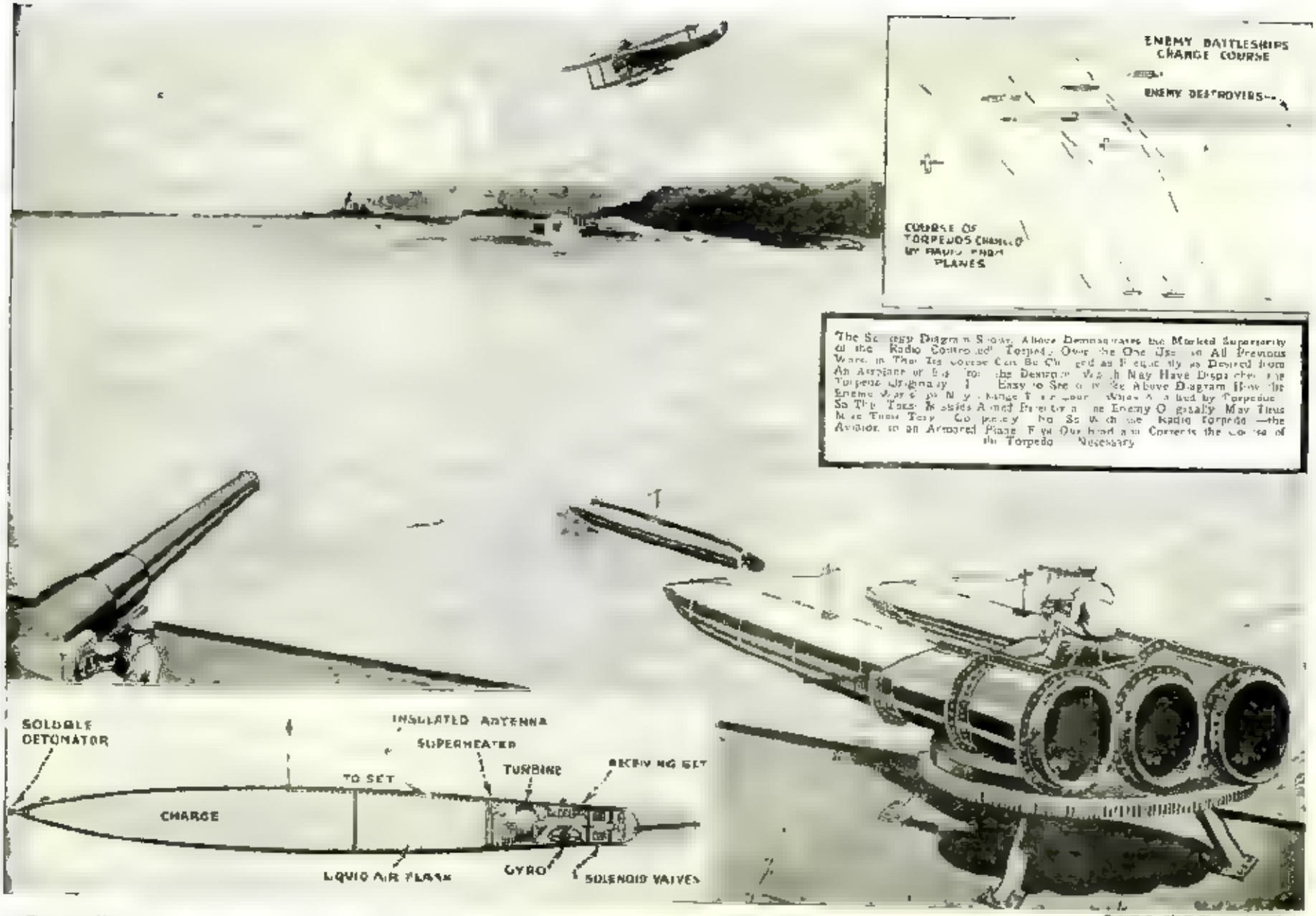

Will Prove Most Disastrous May Be Avoided in a Great Extent Through the Use of Radio Communication. New Theory on Which the United States Bureau of Mines Experiments Are Based. Tests Through Which It Is Hoped to Reveal a Great Value in Dangerous Situations. More Accurate Data Is Expected Soon.

In the following article is shown the Radio Rescue Operations the Bureau Report Made by the Bureau of Investigations Concerning the Government Experiments Made near Bruceton, Penn. These experiments, Made under the Supervision of Mr. [illegible] Jakosky, Showed That Reception from an East Pittsburgh Station Fourteen Miles Away Was Possible with the Receiving Set 100 Feet Underground. Transmission Was [illegible] Most Promising Results Were Obtained in Experiments Where Both Transmission and Reception Were Carried on Underground. Waves Were Received Through a Fair Thickness of Coal. Coal Strata Between Pittsburgh Drawing Reception Was Carried on Through the Strength of the Signals Decreased in Direct Ratio to the Thickness of the Strata. A Horizontal Antenna Was Found to be Practically Useless While a Vertical Loop of One Turn Worked Admirably. The Effect of Hills on the Route Has Little Effect on Reception But That Its Density May Cause Slight Variations in the Strength of the Signals.



www.americanradiohistory.com

# Radio-Directed Torpedo of To-morrow




The Strategy Diagram Shown Above Demonstrates the Marked Superiority of the Radio Controlled Torpedo Over the One Used in All Previous Wars, in That Its Course Can Be Changed as Frequently as Desired from An Aeroplane or Ship, to the Destroyer Which May Have Dispatched the Torpedo Originally. It Is Easy to See from the Above Diagram How the Enemy Warships May Be Kept Many Miles Away and Still Be Attacked by Torpedoes So That These Missiles Armed Presumably with the Enemy Originally May Thus Make Their Way Completely Into Its Midst—the Radio Torpedo—the Aviator in an Armored Plane Flying Overhead and Corrects the Course of the Torpedo as Necessary.

The Large Illustration Above Shows the Triple Torpedo Tube Mounted on the Deck of a Destroyer With the Control Radio-Controlled Torpedo Being Discharged Into the Water Toward the Enemy Vessels. The Aeroplane Is Seen Flying Above Ready to Keep An Eagle Eye On It So As to Send Out Any Correcting Radio-Control Impulses That May Be Necessary. The Detailed View of the Lower Left-Hand Corner of the Illustration Shows the Interior Arrangement of The Radio-Controlled Torpedo. Details by Grosse Schoenheimer, Special Naval Writer for Science & Invention.

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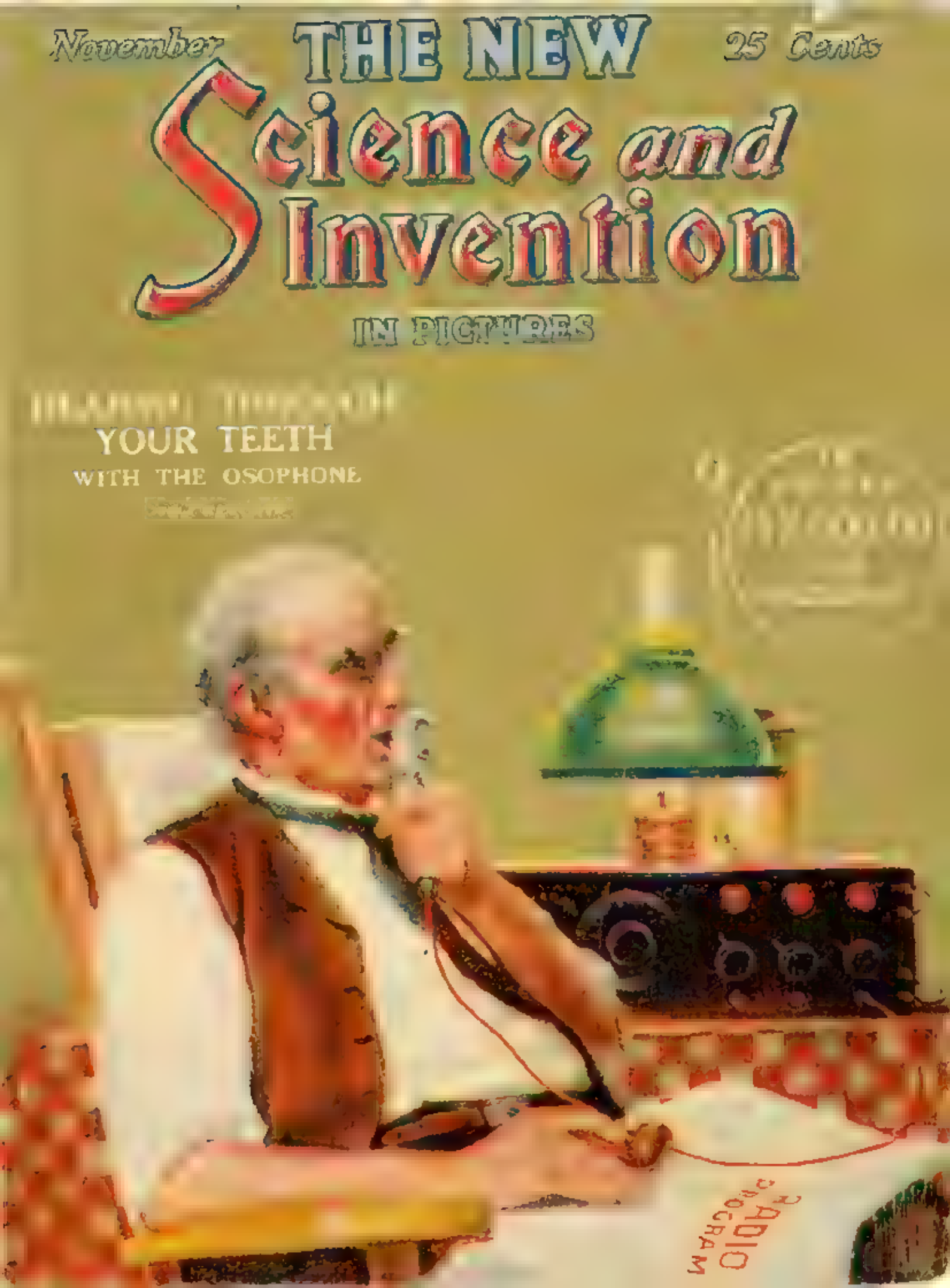
November

# THE NEW Science and Invention

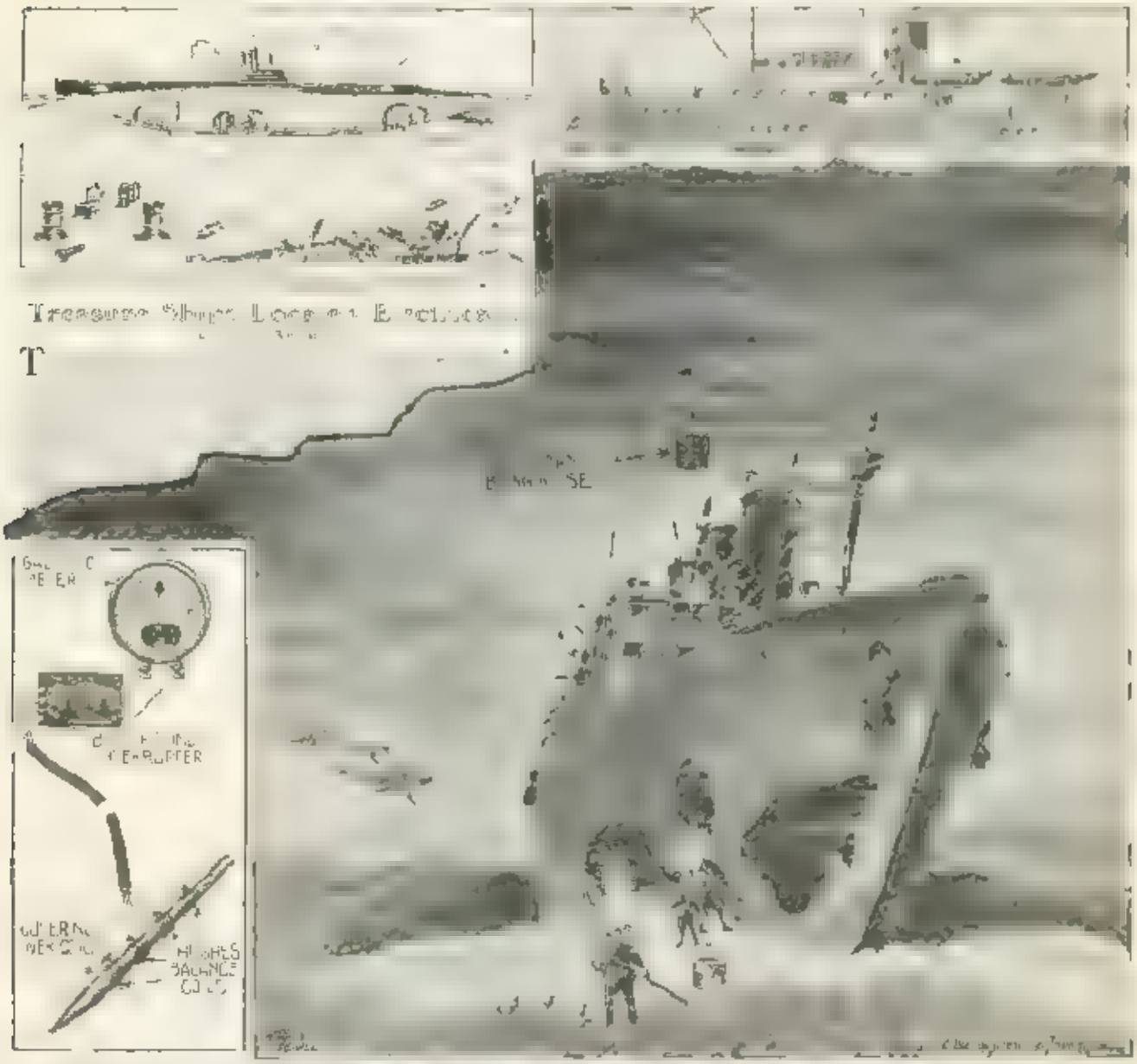
IN PICTURES

25 Cents

YOUR TEETH
WITH THE OSOPHONE



# Electric Finder Saves $30,000,000



A recent dispatch from London states that thirty million dollars in gold bullion was successfully raised from a depth of 150 feet below the surface of the sea. The divers used special electric gear and a grappling device which, however, was not the sole means employed to bring the treasure to the surface. Such an exciting story was this and others of

Grimsback in the October issue of this journal, how called the ELECTRIC TREASURE FINDER, by the aid of which the navy was able to locate the position of the gold. The device is the Hughes balance coil, by means of which electro magnetic waves are caused to vibrate in the earth. Marvels brought about by this and other scientific

## AN APPRECIATION

*for many years*

### A FEW OF THE GOOD THINGS IN DECEMBER SCIENCE AND INVENTION

Fossilized Extinct Animals,
By Dr W A Lux

Salvaging Sunken Ships by Freezing Them in Ice
By Charles Morton

An Amphibian Helicopter Flyer,
Made of Everybody,
By Hugh Langley

Steam Driven Airplane Now Practical,
by Dr A Jemaux

A Marvelous Self-Propelling Ship,
By Edward H London.

Tricks With Matches,
By Walter B Gibson

What Famous Vaticinists Think of Spiritism

Measuring the Heat from Distant Stars,
By Edison Pettit, Astronomer at the Mt Wilson Observatory.

How to Make Your Own Storage Battery

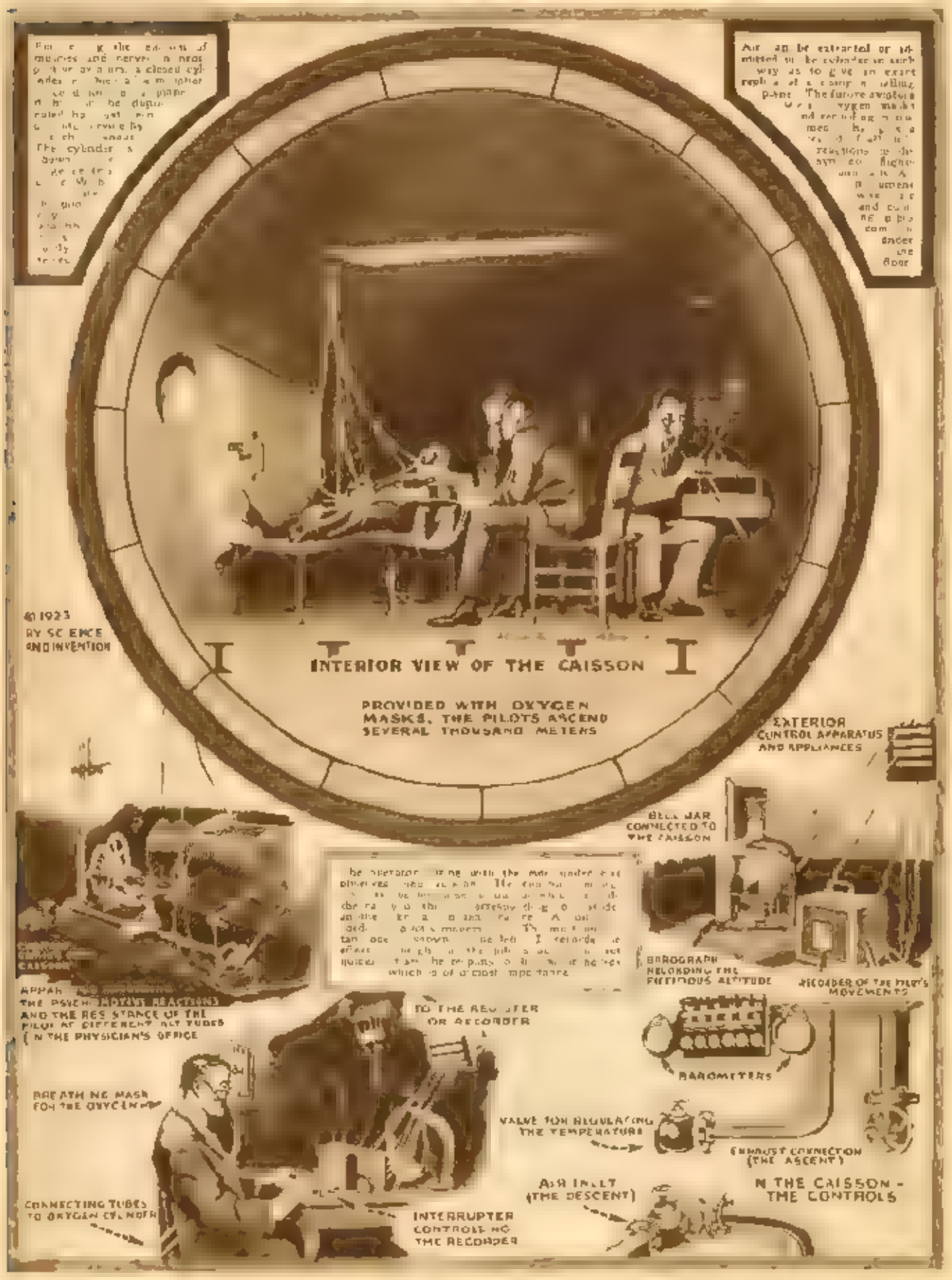
"Bob Cat" –A Wind Sled Driven by Motorcycle Engine,
By G. A. Luers.

How Miniatures of Actor Appears in Some Movie
By Phil Gerson

Combined Cliff Feed Drill Press and Lathe,
By P. O. Mann.

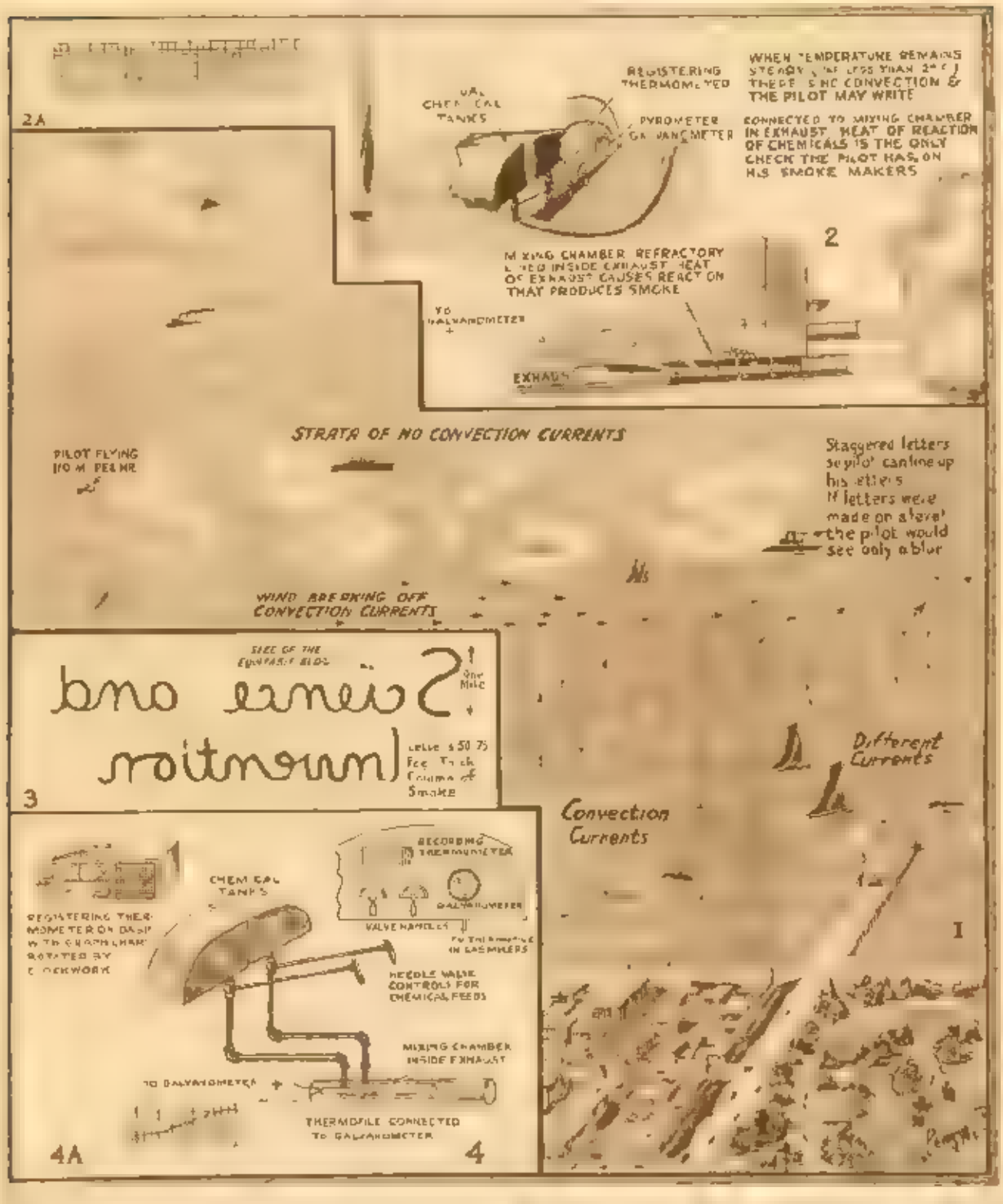
Butterfly Trays: How to Make Them,
By Dr Ellis Dade

# Height Test for Aviators



# Sky-Writing--An Exact Art

By W. B. ARVIN




Arriving 6,000 feet in the air with a column of smoke 75 feet thick using letters a mile high, and at the same time driving a plane at 90 miles an hour requires exactness, sharp corners requires exactness in every way. You may take the word of the aviator, Major [illegible], that the sky-writing he does is a better writing than a pencil can show. This is due to a new record by thermometer [illegible] as sketch 4A. When the graph paper shows a flat [illegible] there is no change in temperature and the aviator knows that the pilot has not written there. A heavy mark in the letters are written at [illegible] speed. From the point of observers all letters appear of equal height. The writing is done by the wind. Major Savage said the writer has done a better writing in a wind five miles an hour gale.

Fig. 1 illustrates the method of staggering the letters 100 feet over each other. Fig. 2 shows the way the writing is done backwards. The device at the rear of the [illegible] flying in New York [illegible] is shown the chemical writing apparatus and the instrument board installed in the light cruiser which [illegible]. Fig. 4 shows in detail how we may make vapor which the smoke producing chemicals flow back into the mixing chamber in the exhaust where they [illegible] are heated. This device is a new record by thermometer [illegible] as sketch 4A. When the graph paper shows a flat [illegible] there is no change in temperature and the aviator knows that the pilot has not written there. A heavy mark in the letters are written at [illegible] speed. From the point of observers all letters appear of equal height. The writing is done by the wind. Major Savage said the writer has done a better writing in a wind five miles an hour gale.

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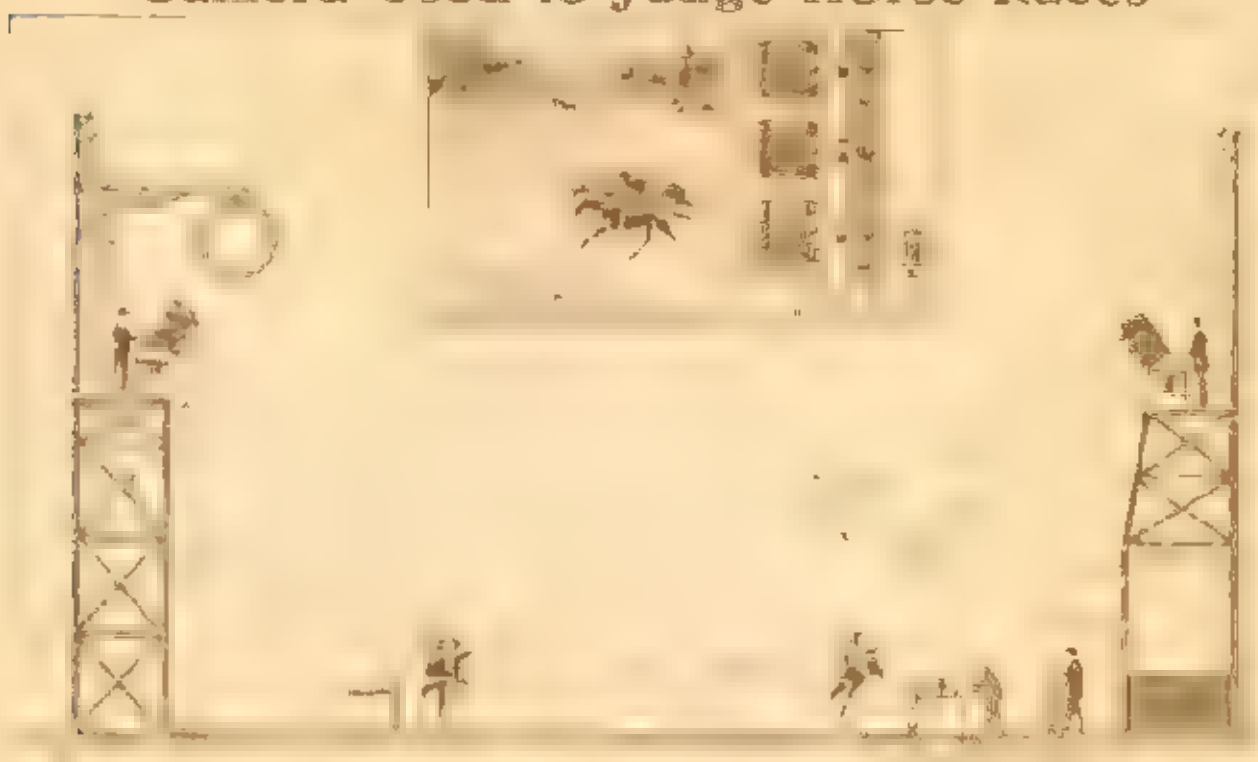
# Electrically Driven Ferryboat

An electrically driven ferryboat with much larger carrying capacity than the old type of side-wheel boat now in use on the Delaware River ferry service by Captain Samuel Golden, the inventor. The boat is entirely controlled from the pilot house. It can be easily maneuvered in a terrible race and rough weather.

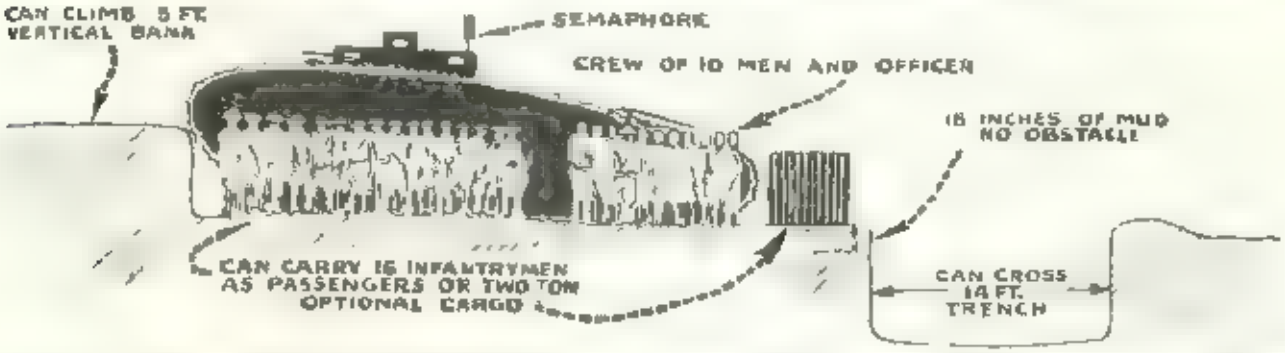
# Camera Used to Judge Horse Races

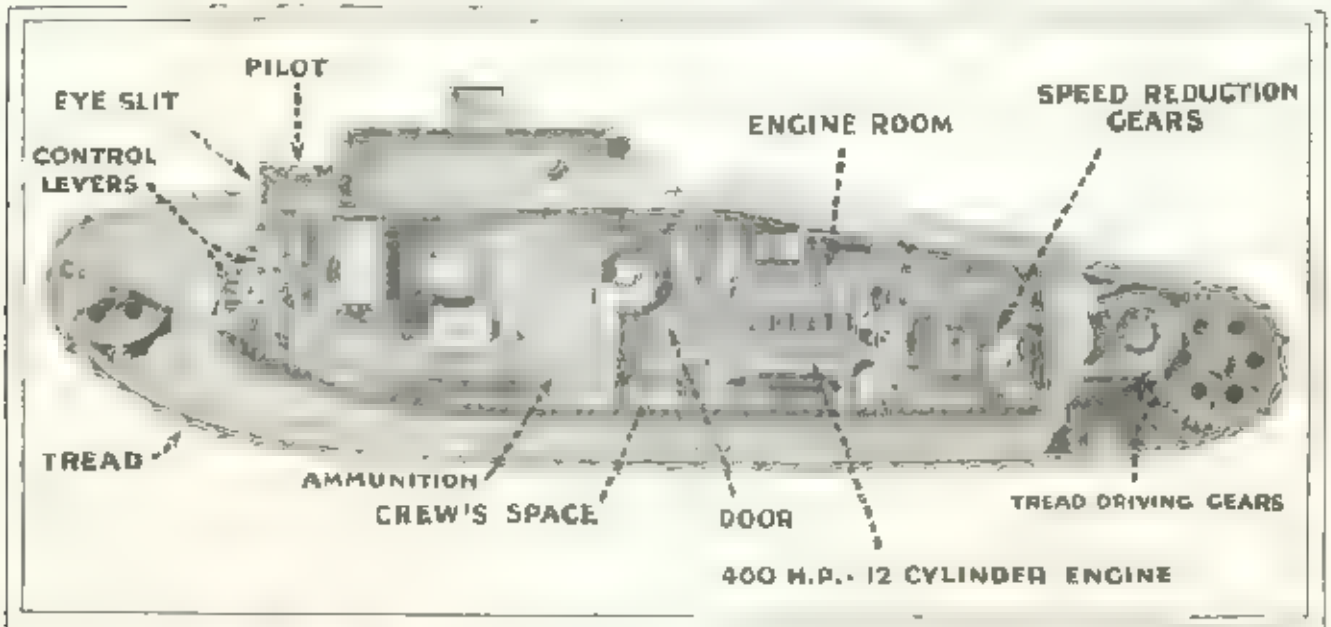


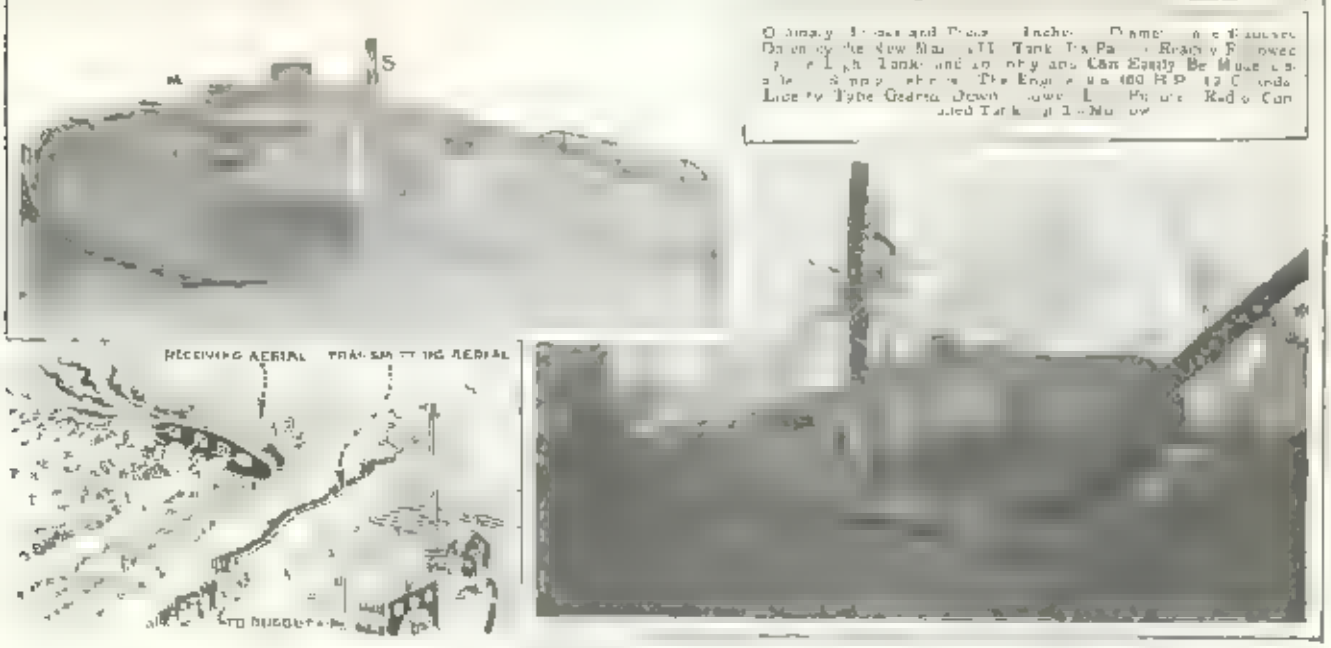
...take the guessing out of deciding the winner in the closest finishes. Lenses cover... the wire here... thread which trips the camera shutter. The picture is flashed [illegible] minutes after the race. Camera C catches the place horse...

# Monster Army Tank Destroyer

By S. D. ROCKENBACH, Commandant U. S. Army Tank School




The General Specifications for the Mark VIII Were as Follows: Weight, 35 Tons; Length, 34 Feet; Width, 11 Feet With Sponsons Out, 8 Feet 6 Inches; Height, 11 Feet; Armor, Proof Against All Small Arms Bullets In Front; Armor Piercing Armament, 5 Machine Guns of Which 4 Can Be Carried Outside; Crew, 11 Men; Speed, Maximum, 8 Miles Per Hour; Power, 10 H.P. Per Ton of Weight; Trench Crossing Ability, 14 Feet; Ability To Climb Vertical Bank, 5 Feet; Pressure, 4.5 Pounds Per Square Inch—Any Ground That Will Support a Man; Communication, Army Tank Co. ... Two Page Signal Sets, 4 Pages; Every Tank Also a Radio Set; Tank Company, Its Numbering, Colors, Signaling, Machine Guns, Armament, Additional Crew, Cargo of Two Tons, Are No Part of; Radius of Action, Obstacles, Mud, Ditches, Stumps, Barbed Wire, Shelled Areas Soaked With Water and Tank Pits

January

25 Cents

# THE NEW Science and Invention

IN PICTURES

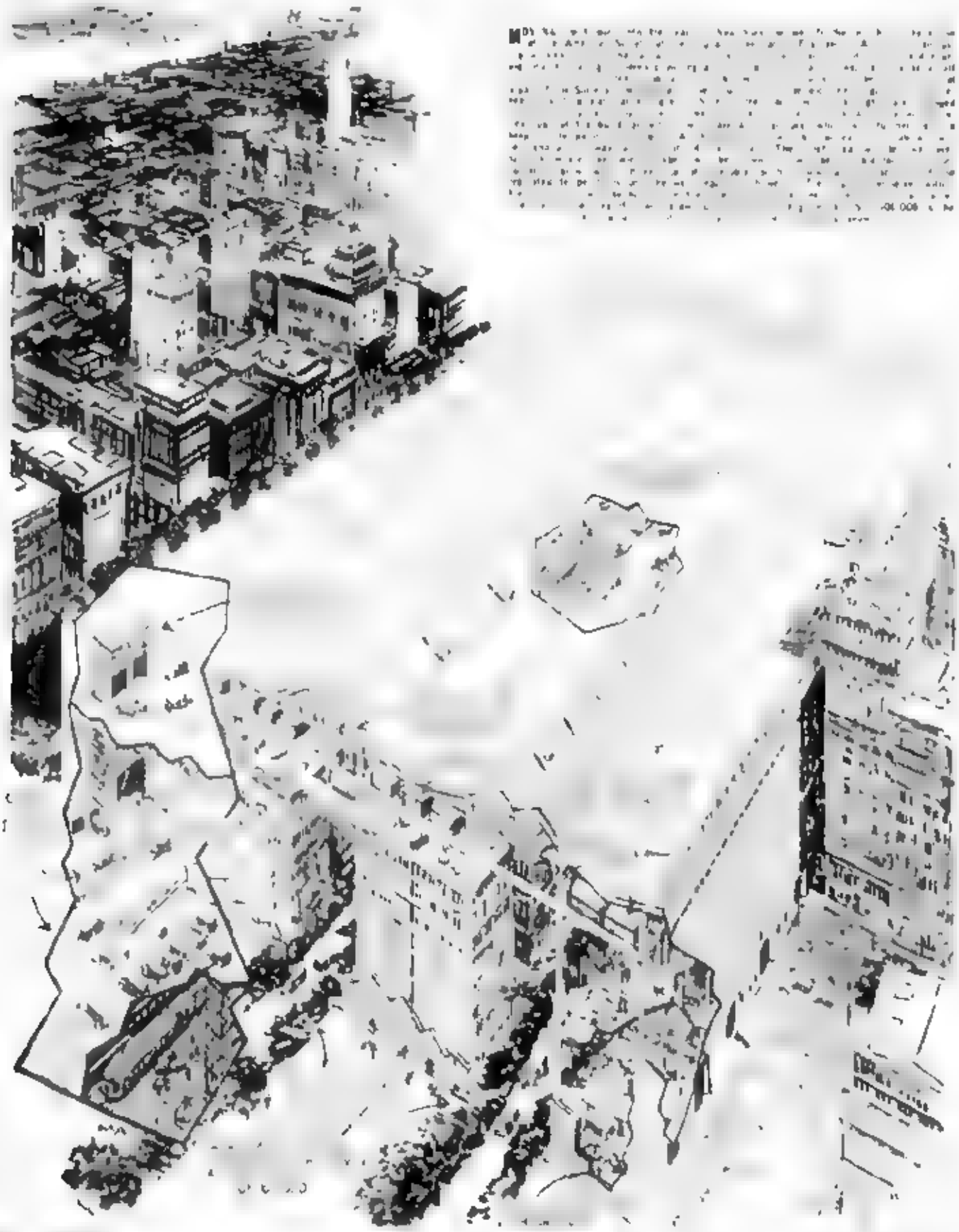
THE RADIO POWER CAR

See Page 855

40 NON-TECHNICAL RADIO ARTICLES

# A Glass Enclosed City

**Glass Enclosed Community to Have Artificial Heat and Rain**



# Radio Power Assured

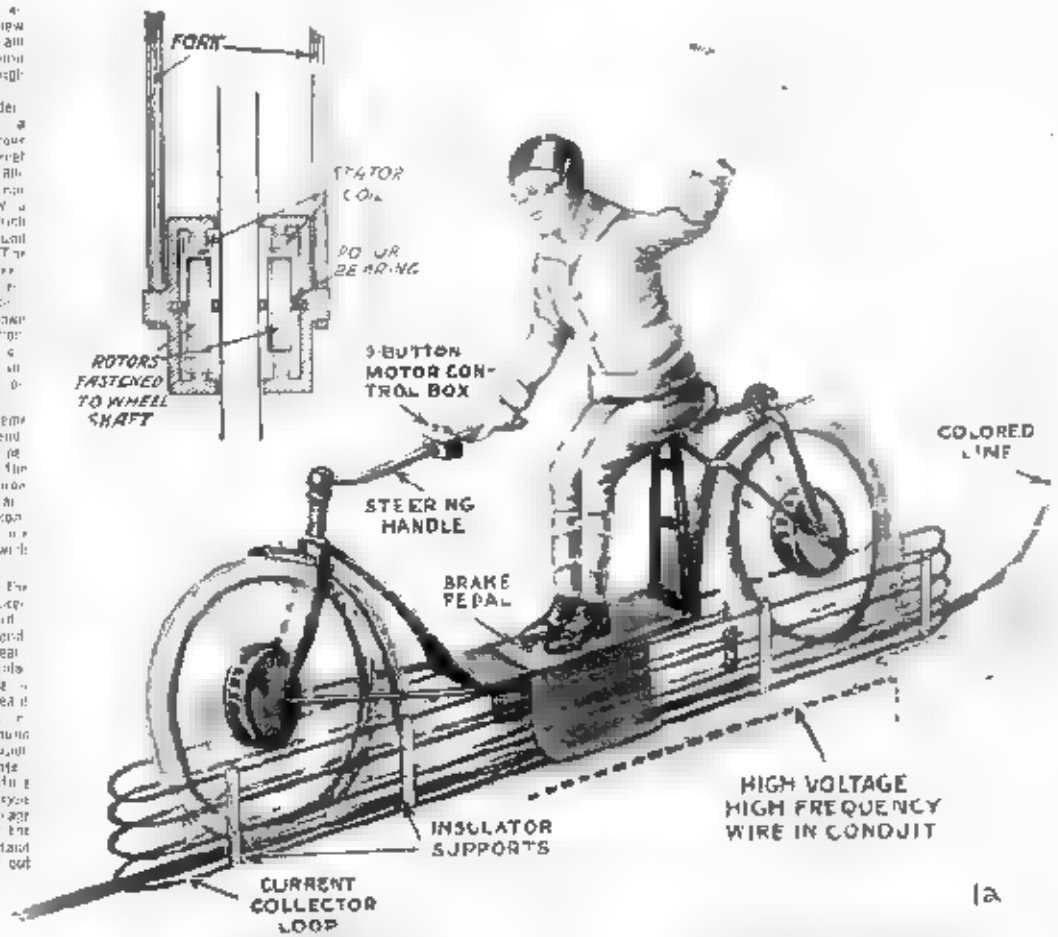
## High Frequency Induction Assures Radio Power Transmission

By G. RNSPACK

FRENCH radio engineers have recently experimented with a new sort of radio power that happily allows now a utilization without future fear of all current into high frequency alternation currents of which would be left to act under ground conductors resembling a tramway are located here and there inches below the level of the street or road. Automobiles, Figs. 1 and 2, run as far as it is desired on rubber and Fig. 4 would carry a number of wire projections which the gravity fan. The driving wheel (electric) would be noiseless. The electric motors on the wheels would derive their energy from a stationary power plant on the side. Other arrangements are shown in Fig. 3 the energy is taken from the overhead wires now in use by electric cars.

The only drawback to the scheme heretofore was the use of a sending out current as a 25,000 cycle per second but with the advent of the radio tube audion it is now possible to solve the problem as French engineers who have constructed models among them have expressed themselves as satisfied with the results.

The new system is to transform the high frequency current as indicated in the accompanying cut up to a cycle of 25 to 50 per cent a second. This result is accomplished by means of inductory motors as in Fig. 4. Besides for of the speed of the vehicle is accomplished very simply by means of a little rheostat on the controller several turns of copper wire wound into a coil. The coil acts upon the current as a faucet or valve passing more or less current. Being automatic operation the cycle allows we carry only a very small battery which is kept charged from the electrified roads. We understand that this system is to be tried out in France very shortly.

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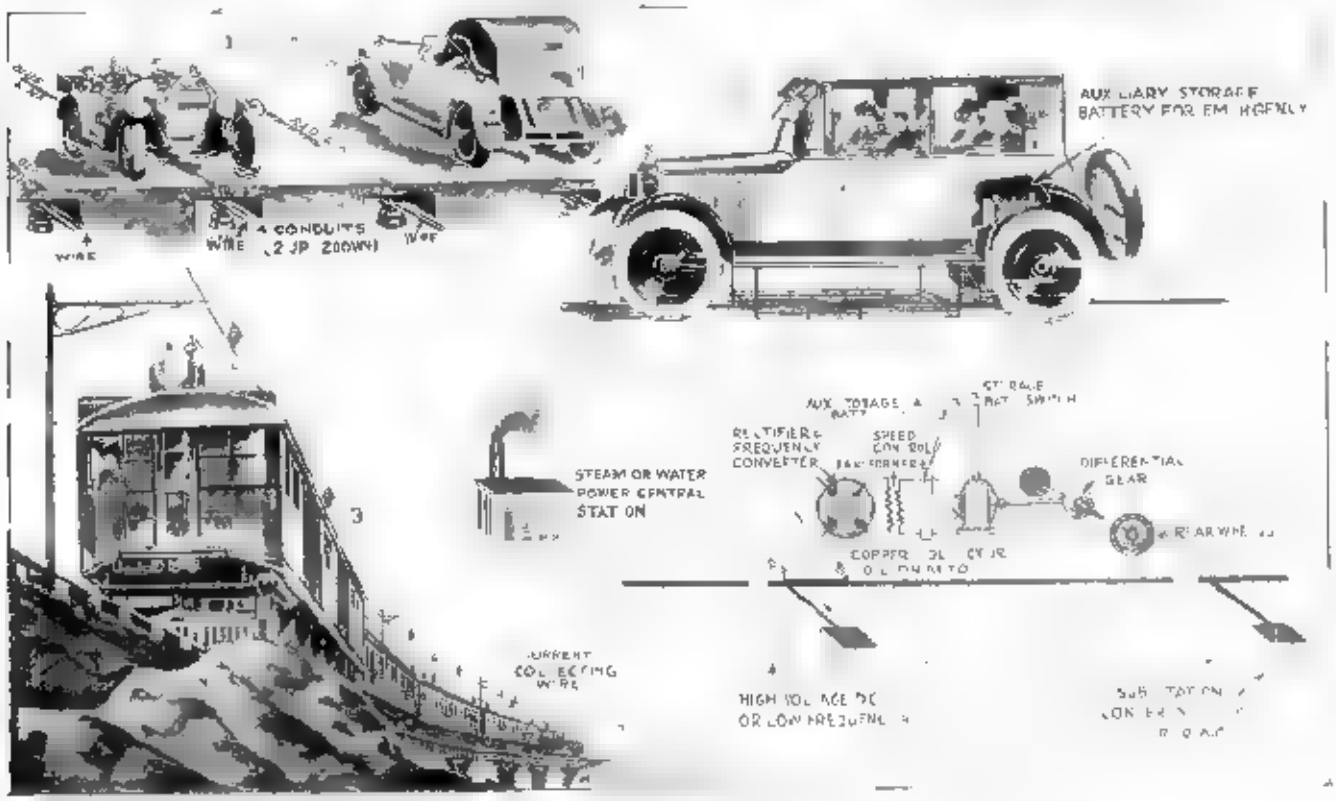
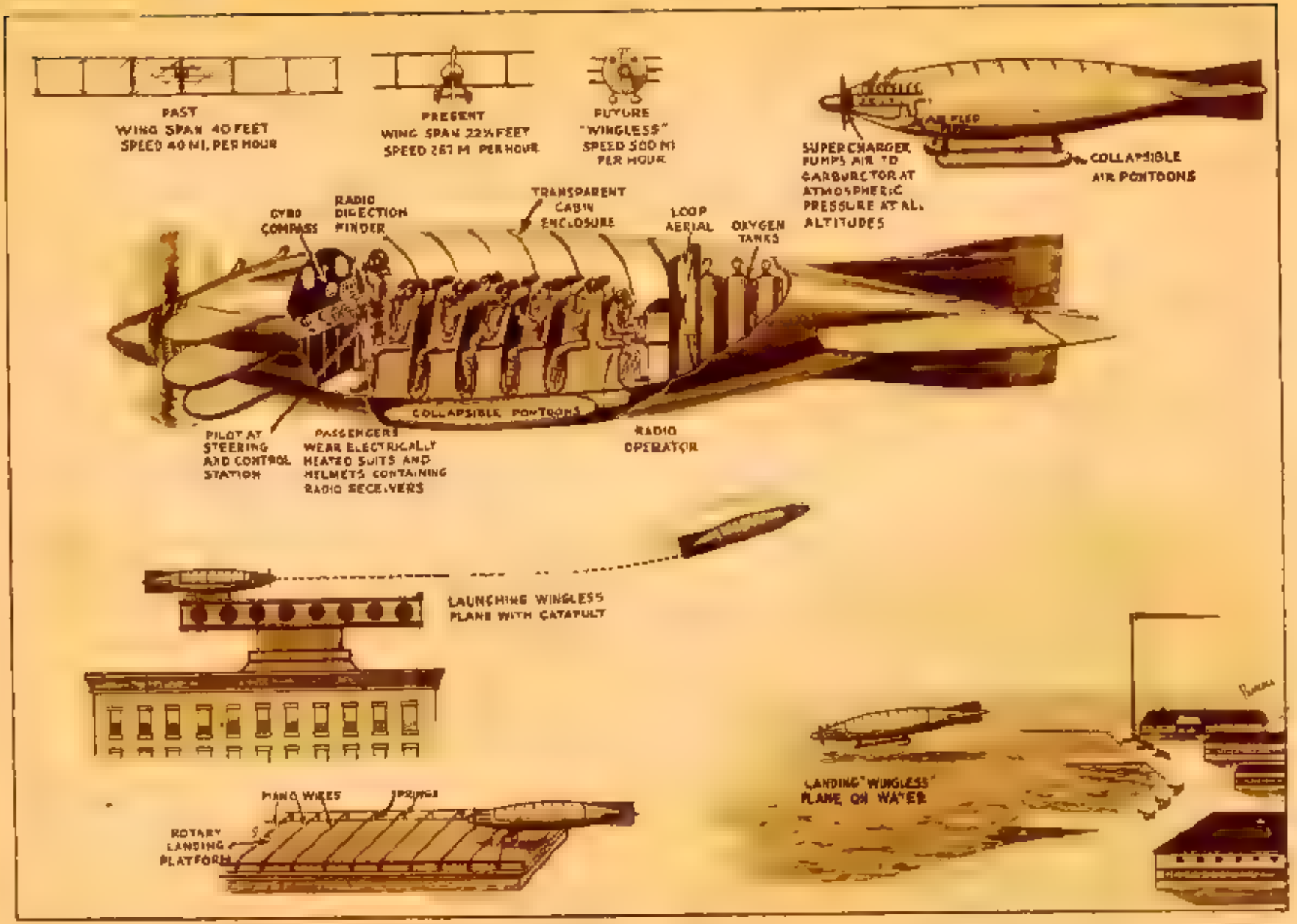


# The Airplane of the Future

## Will Look Like Projectile and Go 500 Miles per Hour.

BY H. WINFIELD SCOTT.




With the making of recent records nearing 300 miles per hour in sustained flight the masters of aviation are seeking ahead to see what the old mode of air travel and construction will be. By going back into the history of the plane from its first appearance on the world's scenes and following the history of its design down to the present time it seems probable that the plane of the future will be very much on the order of a projectile with fins. Such authorities as Prof. E. P. Warner of the Massachusetts Institute of Technology hold this view and state that the only limit on the speed of aeronautics is the power of endurance of the human pilot. By examining the history of the plane we see that the first Wright Brothers plane, capable of forty miles per hour, had a wing spread of forty feet and an engine weighing almost 15 pounds per horse-power. At the present day the planes making the speed records have a wing spread of only twenty-two and one-half feet and an engine drawn up one horse power to every one and one-half pounds of weight. This would tend us to believe the wing spread is to be reduced with the rise in speed. The chief problem here is to design a plane that can alight with so short a wing spread. One solution to this problem is to use pontoons for water landing. Another is the plane wire and spring method as recommended by the U. S. Navy. The wires break the plane's speed effectively. As for taking off, that may be done with the Navy type pneumatic catapult now in actual use.

# Zev-Papyrus Race, Camera War

**How Rival Camera Men Tried to Get Exclusive Pictures of Zev-Papyrus Race.**

BY W. B. ARVIN




The outlawed cameramen—those who plan pay any of the $50,000 to try the privilege to take pictures—of the Zev-Papyrus race, moved their men in defeating their rivals. One disguised himself as a cameraman and set his camera up in a balcony and pan into the field, taking his pictures practically under the noses of the legitimate cameramen stationed on the inside of the rail. Above is shown graphically how the two opposing sides fought to take their pictures. The company that sold the privilege did everything to keep out and the others prepared for any emergency. The legitimate company rightly considered the track with a smoke screen fixed high, but they left one side clear for the use of pilots of the cameraman carried in a line. The men hoped, would the others discover that they were cute. None appeared without them

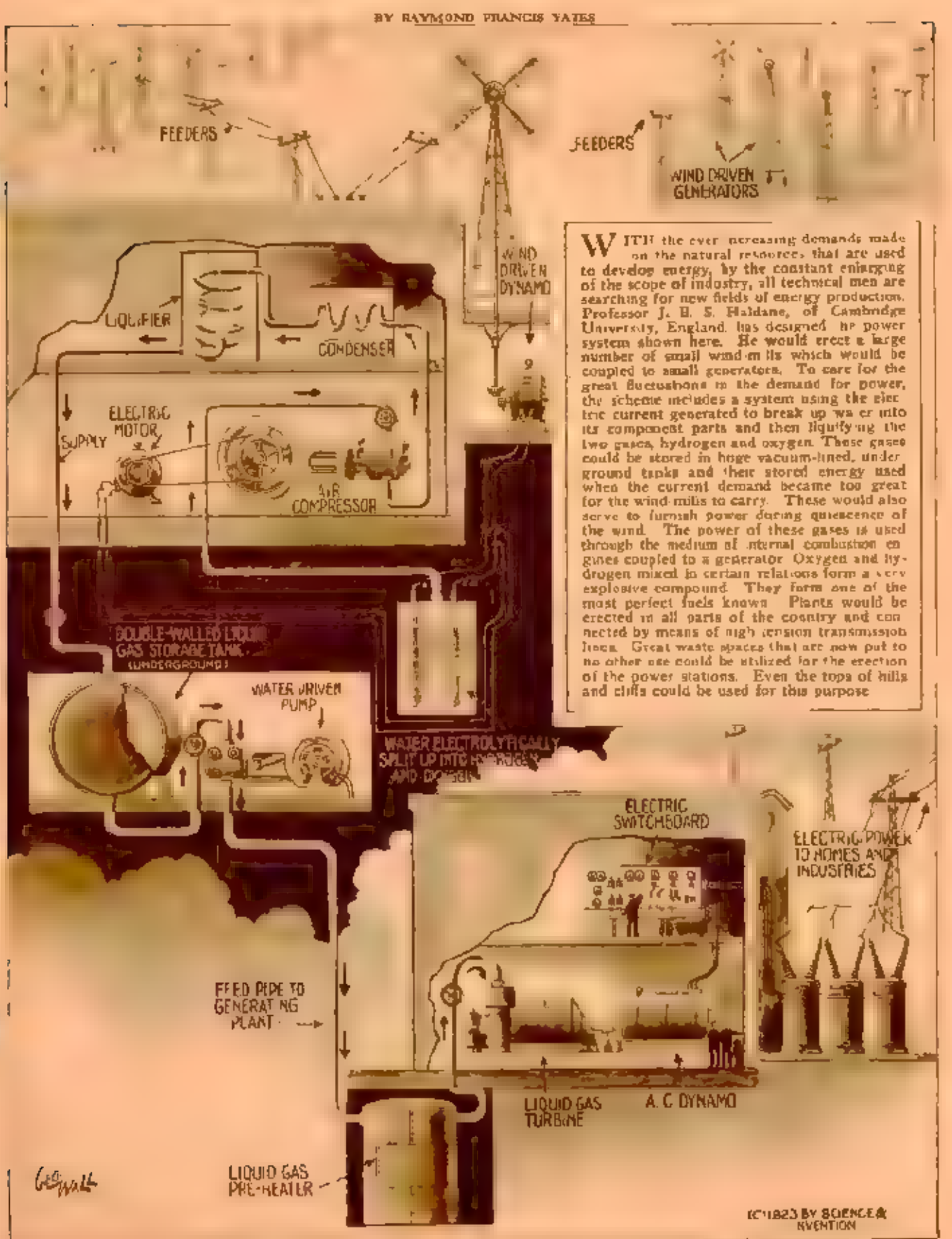
No General in the Great War took more precautions or laid his plans with more care than did the rival movie interests in their preparations for getting pictures of the great international turf event held at the Westchester Racing Association Club in New York when Zev and Papyrus met in the mile and one-half grueling test recently. It is said that one movie firm paid $50,000 for the exclusive rights to pictures of the meet, and that the same offer was made to no less than four other firms before the offer was taken. The movie men maintained that it just was not being done but the management maintained just as stoutly that it was. So the $50,000 was paid.

Then the firm that purchased the rights proceeded to make their rights exclusive. They hired a veritable army of spies to weed out the cameramen who might slip in at the gate. They rented all the houses around the course where their rivals might set up cameras with long distance lenses and even hired a couple of airplanes to patrol over the race course. Then they sent a pair of mirrors around the rear of the course and flashed light beams along the rail of the grandstand in order to blind any disguised picture taking cameras. They even protected the course with smoke pots, a wise act as great clouds of opaque smoke. But they were outwitted. The movie men appeared in delivery vans, in crow's-nests in trees adjacent to the course and even hired a few houses and two airplanes themselves. One company hired two movie actresses with cameras hid in vanity cases

# Huge Wind Power System

**Cambridge University Professor Submits Plan to Harness Wind.**

BY RAYMOND FRANCIS YATES

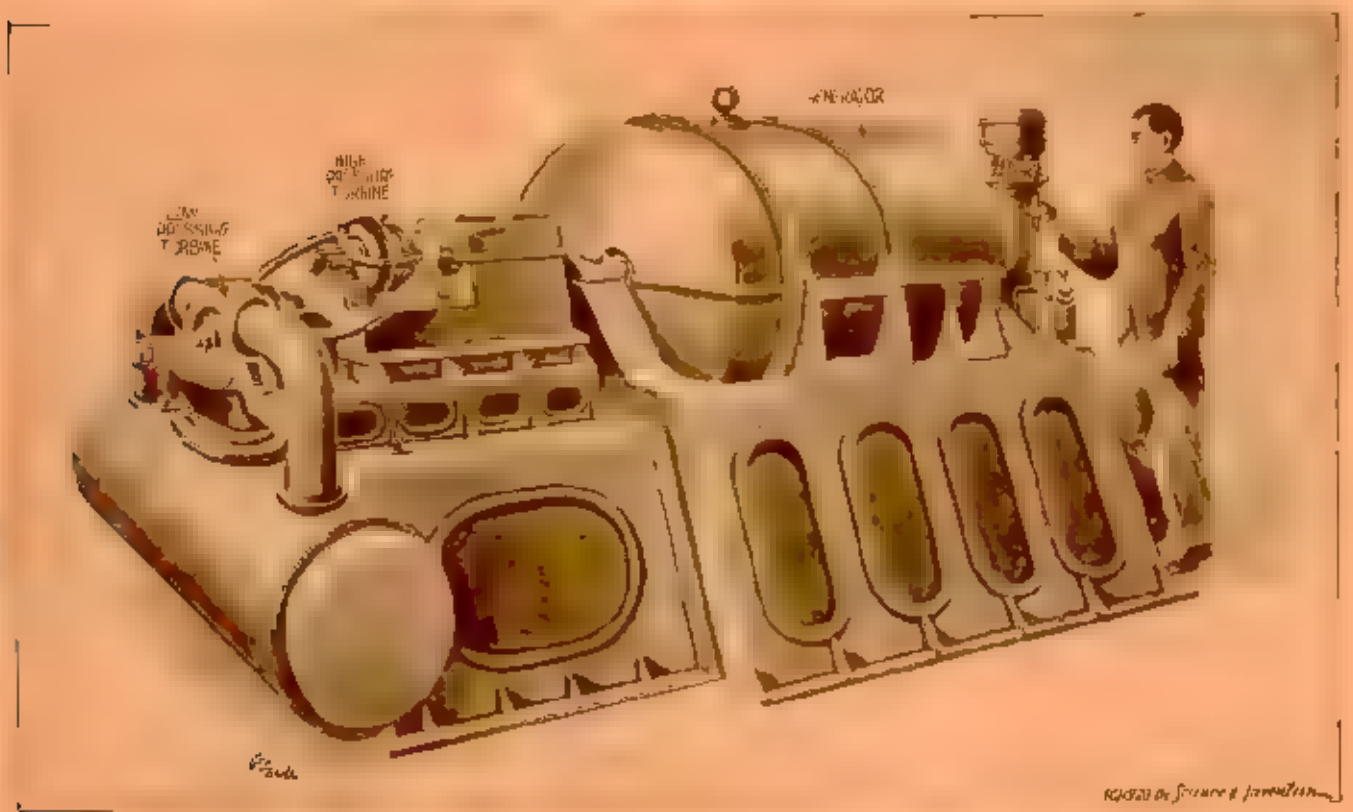



WITH the ever increasing demands made on the natural resources that are used to develop energy, by the constant enlarging of the scope of industry, all technical men are searching for new fields of energy production. Professor J. B. S. Haldane, of Cambridge University, England, has designed the power system shown here. He would erect a large number of small wind-mills which would be coupled to small generators. To care for the great fluctuations in the demand for power, the scheme includes a system using the electric current generated to break up water into its component parts and then liquifying the two gases, hydrogen and oxygen. These gases could be stored in huge vacuum-lined, underground tanks and their stored energy used when the current demand became too great for the wind-mills to carry. These would also serve to furnish power during quiescence of the wind. The power of these gases is used through the medium of internal combustion engines coupled to a generator. Oxygen and hydrogen mixed in certain relations form a very explosive compound. They form one of the most perfect fuels known. Plants would be erected in all parts of the country and connected by means of high tension transmission lines. Great waste spaces that are now put to no other use could be utilized for the erection of the power stations. Even the tops of hills and cliffs could be used for this purpose.

# Million Ton Meteorite Found

A mining company has just started prospect drilling in Canyon Diablo, Arizona, in an attempt to discover the dimensions of a meteorite buried 1,400 feet underground which contains 93 per cent pure iron, 6 per cent nickel and quantities of platinum. The force with which it fell from the sky made the crater shown in the sketch. It is four-fifths of a mile in diameter and probably went to the depth of 1,150 feet. The Navajo Indians deify the meteorite. Its value is estimated at $15,000,000.

# Small Turbine Drives Huge Generator

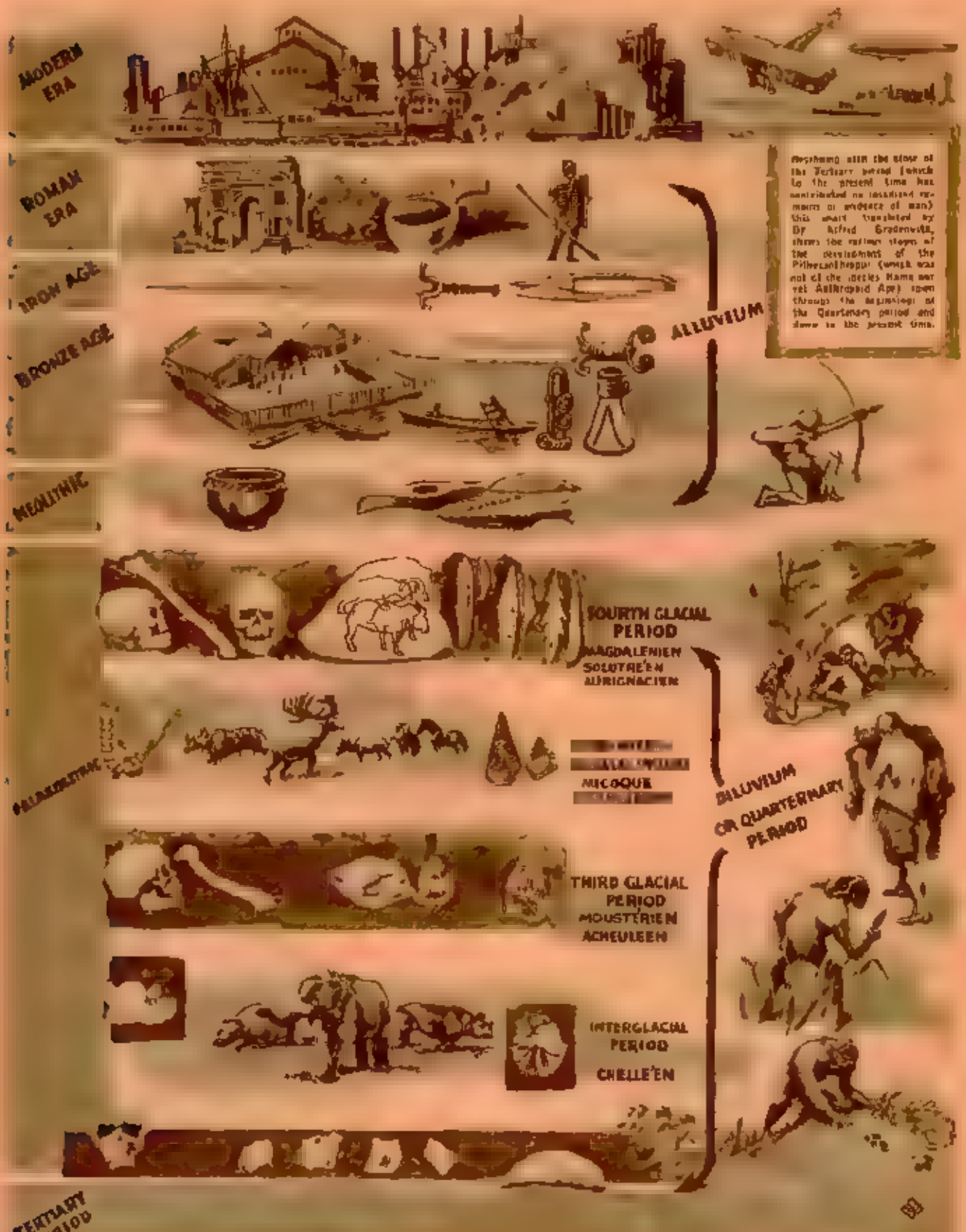



At first the small engine driving the electrical generator seems ridiculously inadequate. But the engine actually develops over thousand horse-power. The new high pressure (1,000) lb. per sq. in. steam pressure turbine is coupled to the low pressure turbine which utilizes one of the exhaust steam. Both are connected through gears. Dr. A. Stodola

# Chart of the Development of Man

## Graphic Depiction of the Rise of Man from the Anthropoid Ape

BY DR. O. HAUSER



April

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# THE NEW Science and Invention

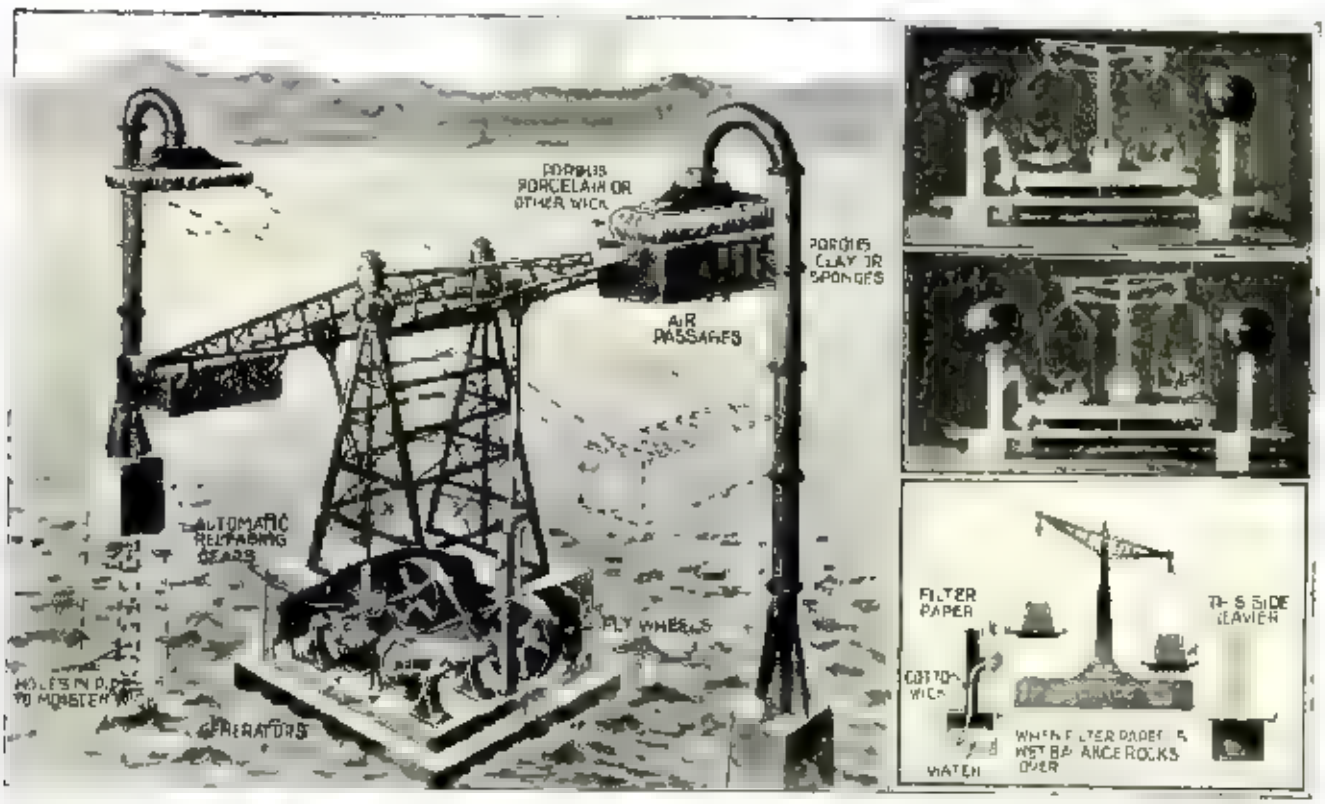
IN PICTURES

## SCIENTIFIC MATING

See Page 1198

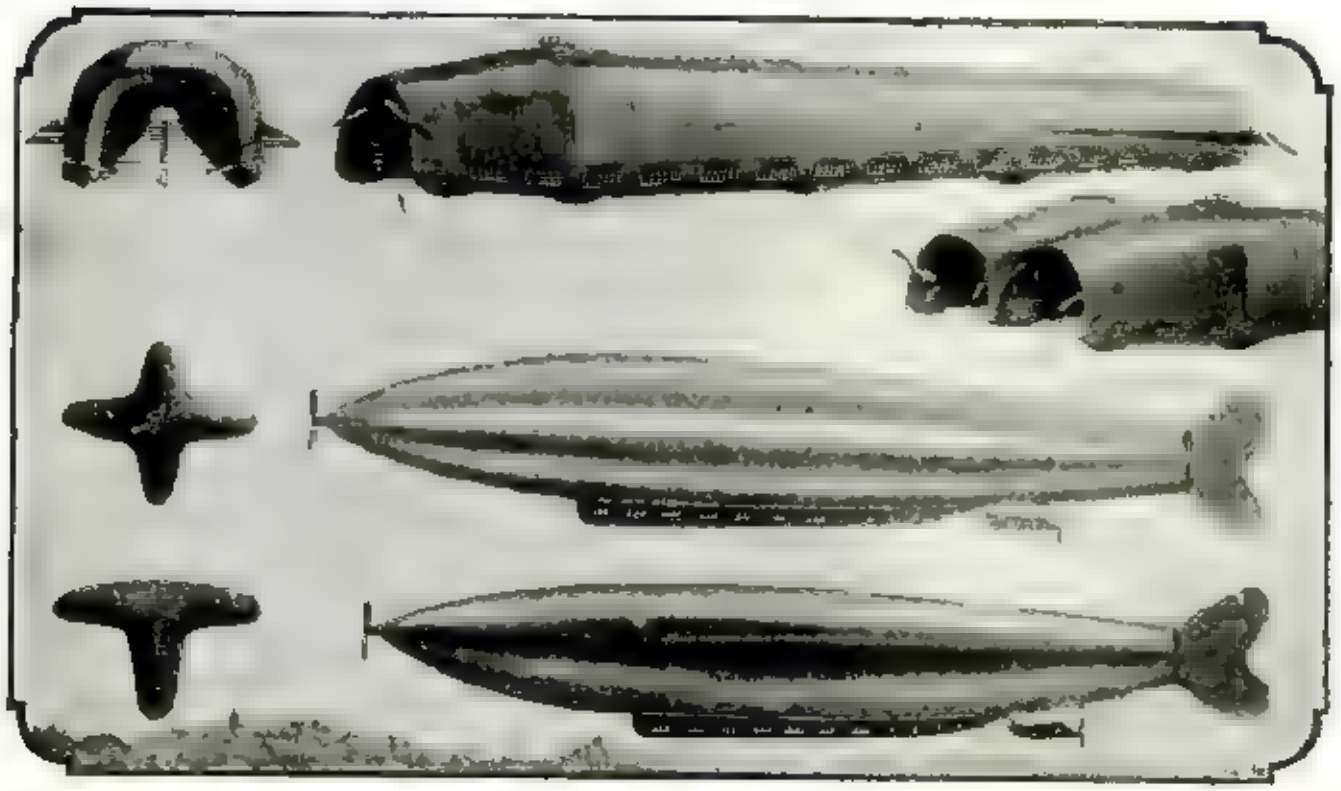
$2000.00 IN PRIZES FOR PICTURES

# Is This Perpetual Motion?




In the motor shown above advantage is taken of the loss in weight due to natural evaporation. Two receptacles are mounted on opposite ends of an arm and are filled with normal alcohol. These absorb water which they in the closed pipe due to capillary action, and when one side becomes water laden, it sinks downward, while the other side rises. It remains in this position until water evaporates from the heavier side and the lighter side absorbs enough water to cause it to overbalance. Big ice box. The down position. The two photographs on the right show a model of the system which actually works. The tellurium rocks back and forth at a rate running from 10 a seconds in the summer to one and a half minutes in the winter. Inset in the photo is a real piece of filter paper attached to one of the beams of the balance. —C. Marshall.

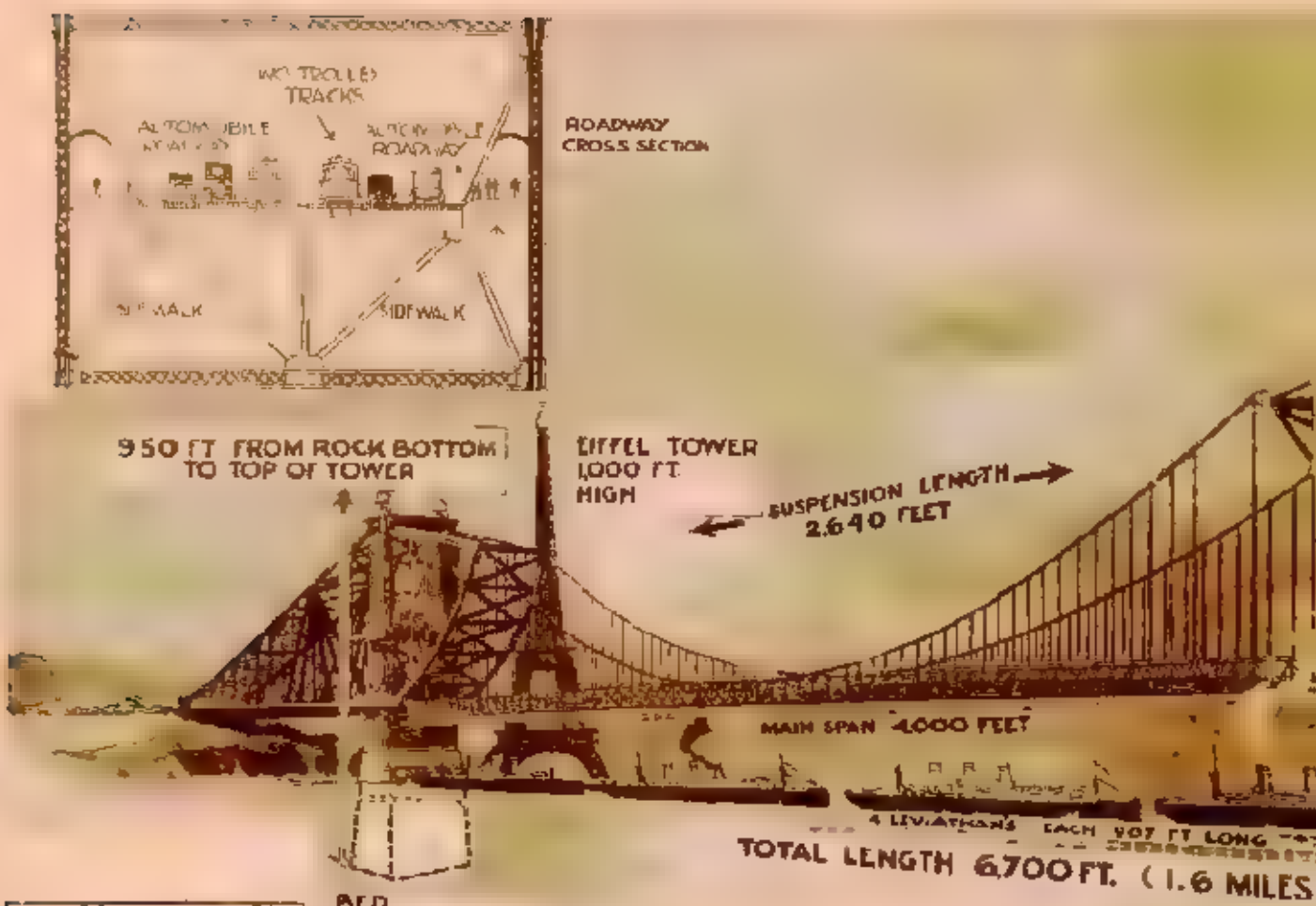
# Construction of Super-Airships



While the lighter than-air machine is highly adapted to actual freight and passenger service of large extent, it will probably take one of the three forms shown above—one the world's most famous aeronautical engineers are agreed that these types are the most safe and dependable yet devised. They were designed by Colonel Alfred de Pass, a French engineer. The elevated picture on the 205 foot and one make a speed of 130 miles per hour. The X- and T-type provide passenger ability. —Alan A. Hynds.

# World's Greatest Bridge

**Monster Span Will Incorporate Cantilever and Suspension**

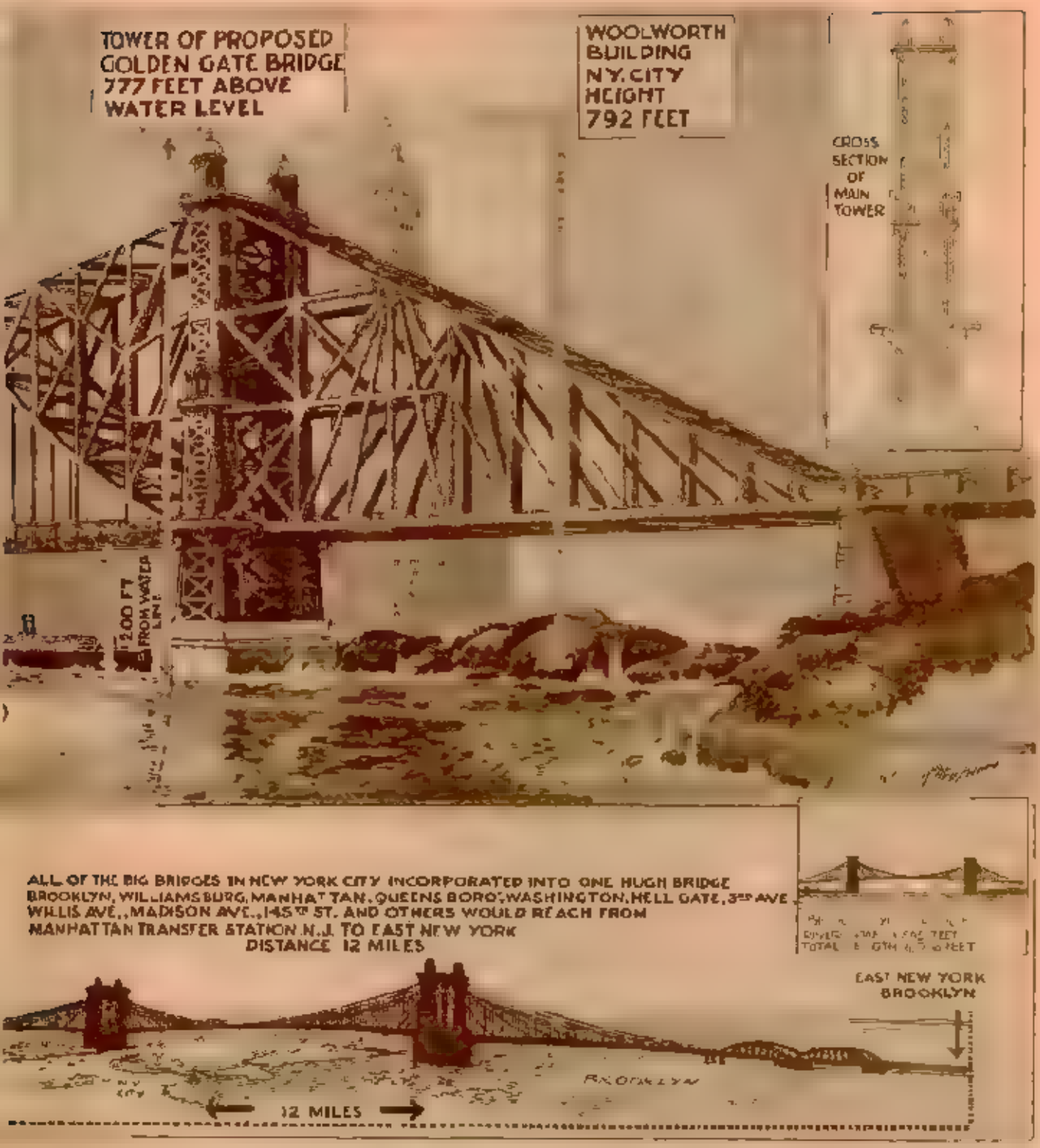


OBSERVATION TOWER SHOWING ELEVATOR

WHAT will be the biggest bridge in both length of span and height of suspension in the world, if it is constructed will be the contemplated Golden Gate bridge between San Francisco, Cal., and the opposite northern peninsula. The total length of the central span of the bridge from shore to shore will be 6700 feet. At 1345 feet from the shore on each side the water is more than 300 feet deep. This makes the total length of the central span of the bridge 4000 feet. In order to effectively support a carrying structure across this great space it will be necessary to use both the cantilever method and the suspension method. From the towers which are 777 feet above the water level, the cantilever construction will extend back to the approach and over the water. The cantilever arms will extend 660 feet out into the main span and from the end of these arms suspension cables will be used. The towers upon which the bridge will be suspended, will have a total height of more than 950 feet, making them almost as tall as the Eiffel Tower. The design shown here was worked out by J. B. Strauss, an eminent bridge engineer who is president of a Chicago bridge company. The reason for the combination of the two systems of suspension, according to Mr. Strauss is that the cantilever type demands too heavy construction for such a long span, incurring an extraordinarily heavy frame in order to support the weight of the bridge itself, aside from the demands made by the weight which the bridge is to carry. On the other hand, suspension cannot be used alone since the length would give the bridge a great lack of rigidity—which rigidity is essential in constructing spans the length of the one contemplated. The two main cables which would be necessary to support the bridge would be one mile in total length and would weigh approximately 5,250 tons. Their cost would closely approximate two and a half million dollars. The width of the roadway space would be eighty feet; there would be one single deck only. The suspension span would be 750 feet longer than the proposed Hudson River bridge. One of the chief problems confronting Mr. Strauss in the design of this bridge was the fact of the existence of very high winds at the point where the bridge is to be constructed. The added strain placed on the structure by this element had necessarily to be considered at every point.

# for Golden Gate

Structure to Cost $17,000,000




In the top illustration above is shown a comparison between the height of the Woolworth Building, the highest structure in New York, and the height of the towers which will support the proposed San Francisco bridge. Elevators will be installed in the towers which will carry observers to galleries which will be built at their tops. This will give a wonderful view of all the San Francisco harbor. A cross-section of the tower showing the method of construction is given in the insert at the top drawing.

Speaking of bridges, we see graphically illustrated below Mr. Charles Nevers Holmes' idea of giant New York bridges. The large 12 mile bridge shown incorporates all the New York bridges built in the last 5 years. Were this 12-mile bridge stretched across from New Jersey to Long Island, it would pass first over Manhattan Island, having one pier built on the Jersey shore, the other would fall toward the center of Brooklyn, while the approaches would carry the total length clear across the width of Brooklyn and well over towards the center of Jersey City. In the inset is shown the comparative size of the famous Brooklyn Bridge.

# Preparations Made For

## Huge Tanker Rebuilt as Mooring Vessel

BY GRASER SCHORNSTHEIMER

The contemplated trip of the world's largest airship the *Shenandoah* to the North Pole, entails much more preparation than the mere plotting of a course and filling the tanks with gasoline. One of the first necessities which had to be met by naval engineers in preparing for this flight was the building of some sort of a movable mooring base. They hit upon the plan of building a mooring mast aboard a vessel. The mast will be very similar to the one now used by the big ship at its base at Lakehurst, N. J. This mast is shown in the illustration at the left. A duplicate of this mast will also be erected at some point probably up near the Arctic Circle in Alaska which will serve as a starting base for the last leg of the Trans-polar flight. A temporary base with supplies and repair-shop will be built at the same place.

This relief map shows a number of the various proposed routes which may be settled upon by the Naval engineers for the flight. One of the chief reasons for the Trans-polar trip is to make discoveries through a large unexplored area which lies between Cape Barrow, Alaska and the Pole. A study of weather conditions, fuel and supply possibilities, will probably be the final factors in the selection of the route finally taken. The flight will end at Spitzbergen where the *Patoka*, the mooring ship pictured at the bottom of the opposite page, will be stationed to await the dirigible's arrival. The unexplored area on the map has been the subject of a great amount of conjecture. It has been said that a warm continent heated probably from a geyser or a volcanic formation exists in this area.

Here is shown the United States ship *Ramapo* as she now appears. She was originally built as an oil tanker for the Emergency Fleet Corporation. She will be rebuilt as a mooring vessel for the *Shenandoah*. She has a displacement of approximately 17,000 tons.

# Shenandoah's Polar Flight

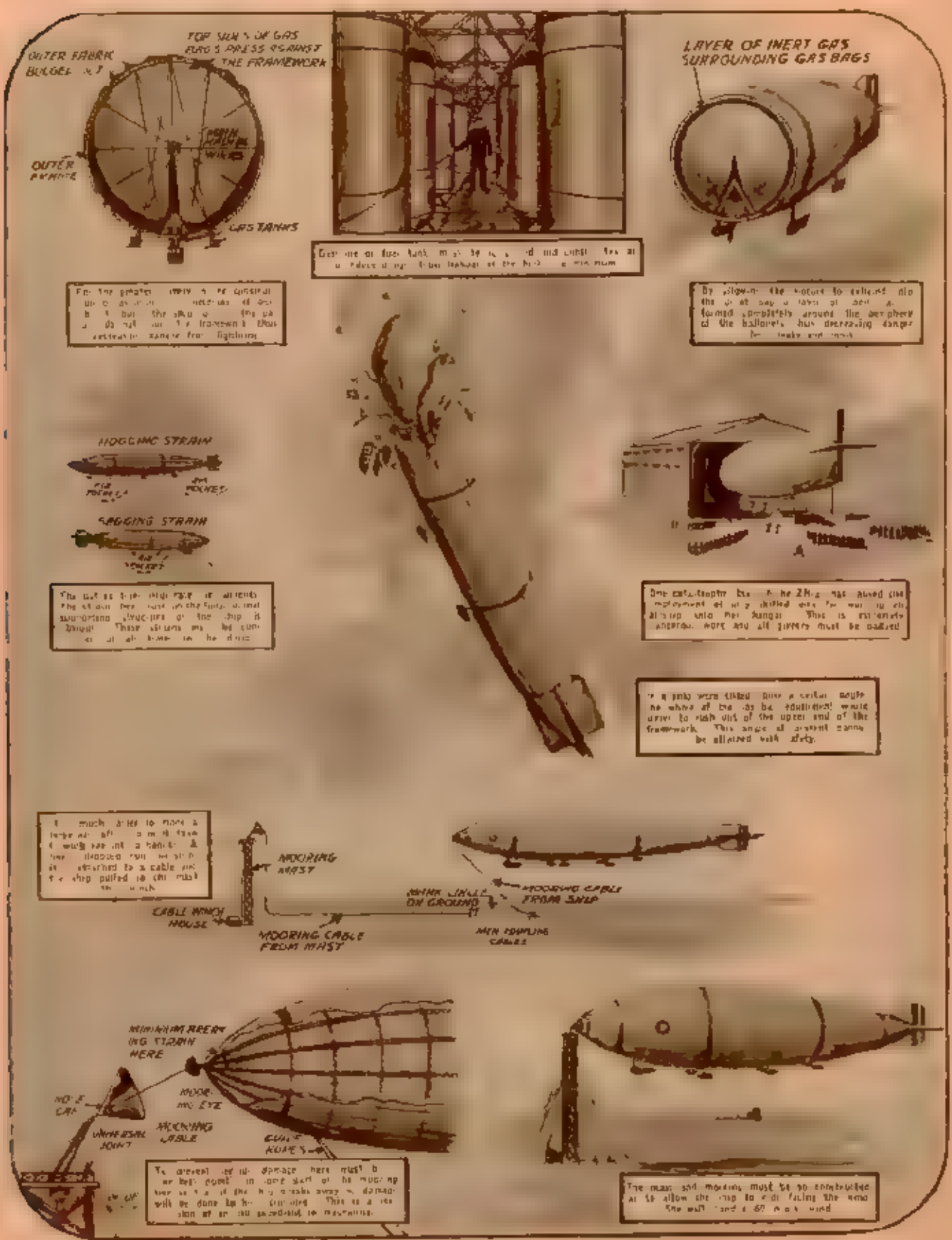
**The Discovery of Warm Polar Continent a Probability**

NAVAL ENGINEER

Above we have a drawing showing how the *Patoka* will look fitted out for her rôle of mooring vessel for the *Shenandoah*. The vessel will have a small mooring mast, will have ample storage capacity and carry an emergency supply of helium gas for the use of the airship. She will also be equipped with a repair shop from which any necessary repairs incurred during the flight may be remedied before she starts on her return voyage. There will also be a sort of airplane hangar aboard the vessel where airplanes will be carried

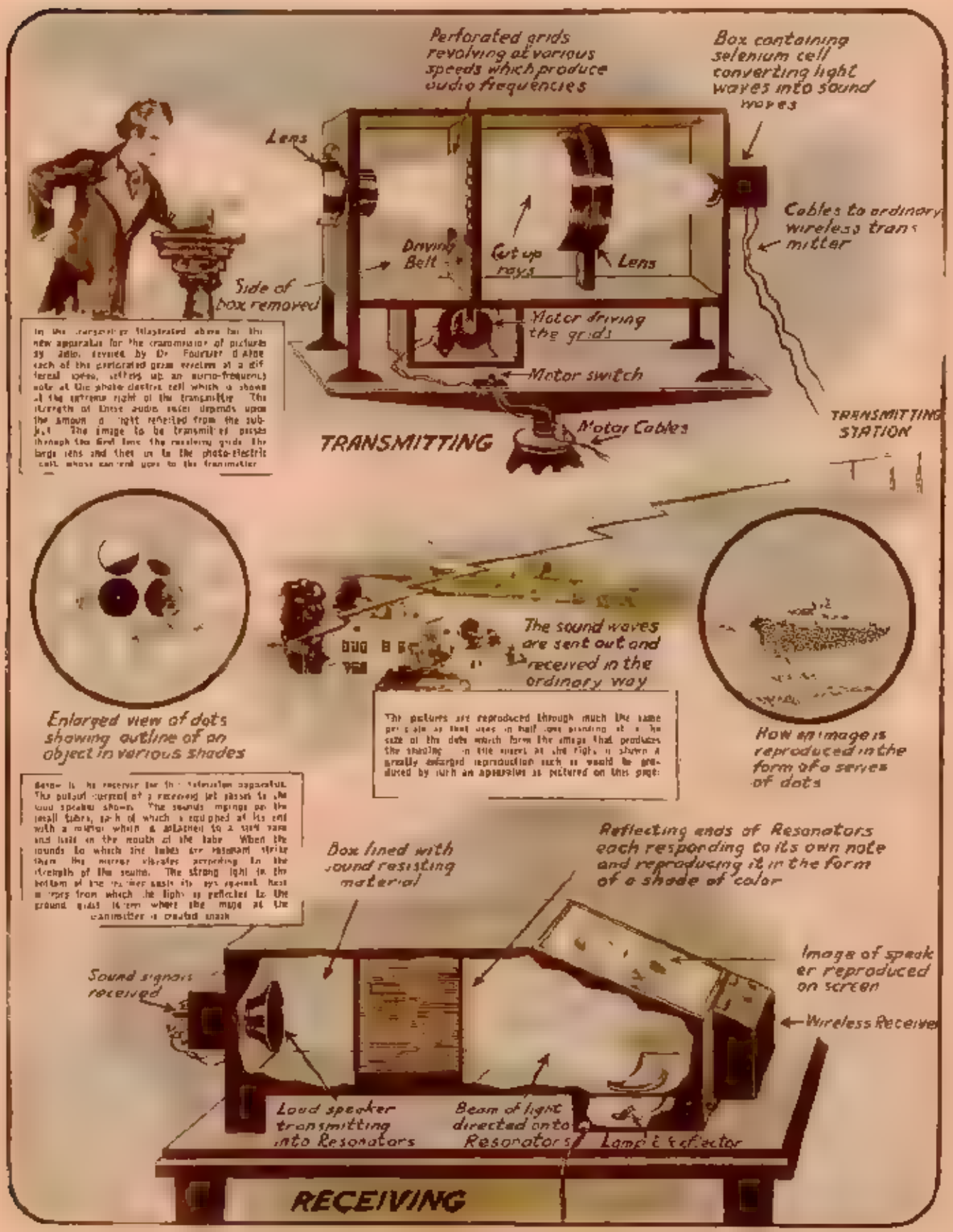
What the cross-section of the *Patoka*, rebuilt, will look like when she leaves for her trip to Spitzbergen, note that she will run practically empty. One of the outstanding points of construction in this vessel is the installation of the helium storage tanks, aft, and the installation of piping from the tanks up the mooring mast and to hose so that the giant airship may have her supply of gas replenished with the least possible expenditure of time and trouble. The details of construction of the mooring mast are plainly shown

# Problems of Airship Construction



# Vision Via Sound Waves

**Audio-Frequencies Act as Carrier Waves**



# Scientific Mating

**Science Shows How To Be Happy Though Married**

By H. GERNSBACK
MEMBER, AMERICAN PHYSICAL SOCIETY

HOW much would the average man or woman give to know beforehand if his or her prospective married life is to be a success or failure? At present marriage is a lottery. It seems impossible to predict beforehand how your prospective mate will turn out in the future. There are, however, certain fundamentals, which can easily be ascertained, one can be reasonably certain as to one's choice. We take extreme care in breeding horses, dogs and cats, but when we come to ourselves we are extremely careless and do not use our heads nor the means that science puts at our hands for scientific breeding. There are certain basic tests which can be made today, and which will give one a reasonable assurance of married happiness.

Physical correlation ranks first in a successful marriage. In the lower left hand illustration, also on our front cover, we have shown how physical correlation can be checked up for each individuals. Both candidates for marriage are equipped with electrodes at the wrist for operating the electrical sphygmograph which records the pulse beat, around the chest of each is a chain which is secured to a piece of spring covered by a rubber hose. One end of the tube thus formed is sealed, the other connects to a manometer and also to a tambour equipped with a stylus. The stylus leaves a record on a moving paper tape showing the rate of respiration. Around the arm of each party is an inflatable band, the tube of which connects to a tambour leaving a record of muscular contractions.

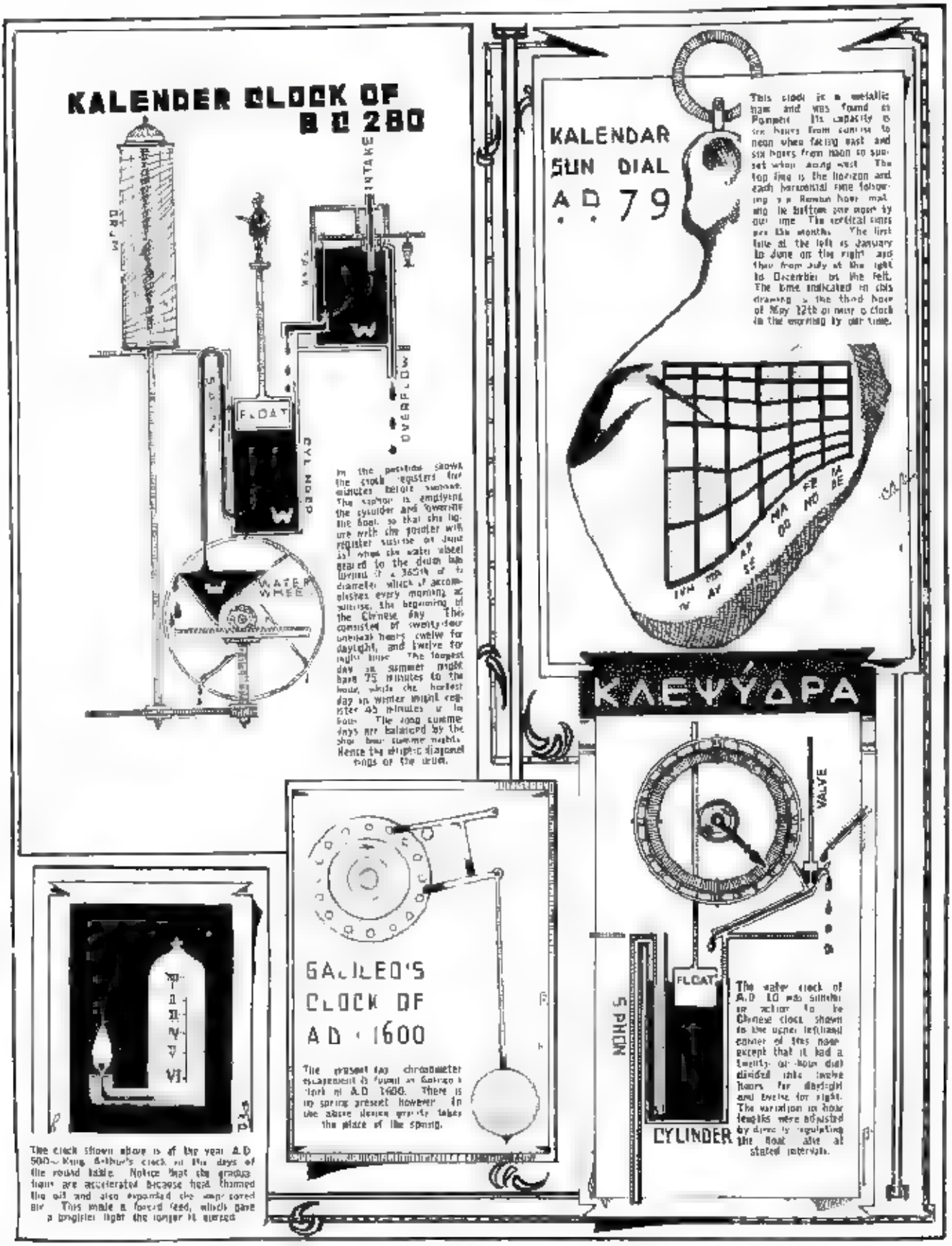
By means of these instruments, it is possible to check up the emotions of each when embracing or kissing. If the apparatus does not give a certain maximum of one of

*(Continued on page 1269)*

# Ancient Clocks

## China's Water Clocks Date Twenty Centuries Before Christ

BY CHARLES BEECHER BUNNELL




In the pendulum shown the clock registers five minutes before sunset. The siphon is emptying the cylinder and lowering the float so that the figure with the pointer will register sunrise on June 21st when the water wheel geared to the drum has turned at a 365th of its diameter which accomplishes every morning at sunrise, the beginning of the Chinese day. This consisted of twenty-four unequal hours twelve for daylight, and twelve for night time. The longest day in summer might have 75 minutes to the hour, while the hortest day in winter might register 45 minutes to an hour. The long summer days are balanced by the short hour summer nights. Hence the slight diagonal rows of the dials.

This clock is a metallic plate and was found in Pompeii. Its capacity is six hours from sunrise to noon when facing east and six hours from noon to sunset when facing west. The top line is the horizon and each horizontal line following is a Roman hour marking be before one more by one time. The vertical lines are the months. The first letter at the left is January in June on the right and then from July at the left to December at the left. The time indicated on this drawing is the third hour of May 12th or nine o'clock in the morning by our time.

The water clock of A.D. 10 was similar in action to the Chinese clock shown in the upper left hand corner of this page except that it had a twenty-four hour dial divided into twelve hours for daylight and twelve for night. The variation in hour lengths were adjusted by time by regulating the float valve at stated intervals.

The clock shown above is of the year A.D. 500— King Arthur's clock in the days of the round table. Notice that the graduations are accelerated because heat thinned the oil and also expanded the compressed air. This made a forced feed, which gave a brighter light the longer it burned.

GALILEO'S CLOCK OF A D 1600

The present day chronometer escapement is found in Galileo's clock of A.D. 1600. There is no spring present however in the above design which takes the place of the spring.

June

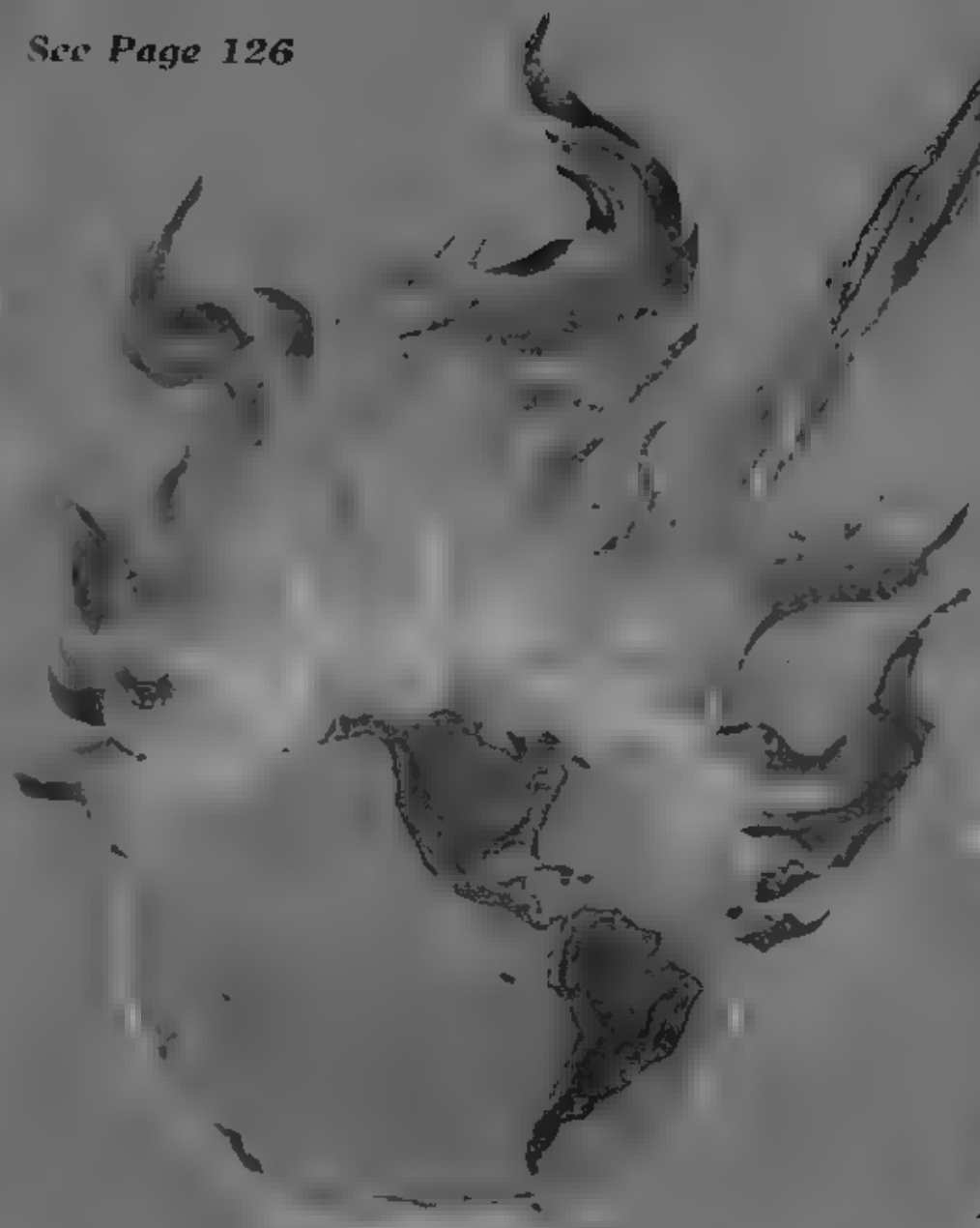
25 Cents

# Science and Invention

## IN PICTURES

## THE END OF THE WORLD

*See Page 126*



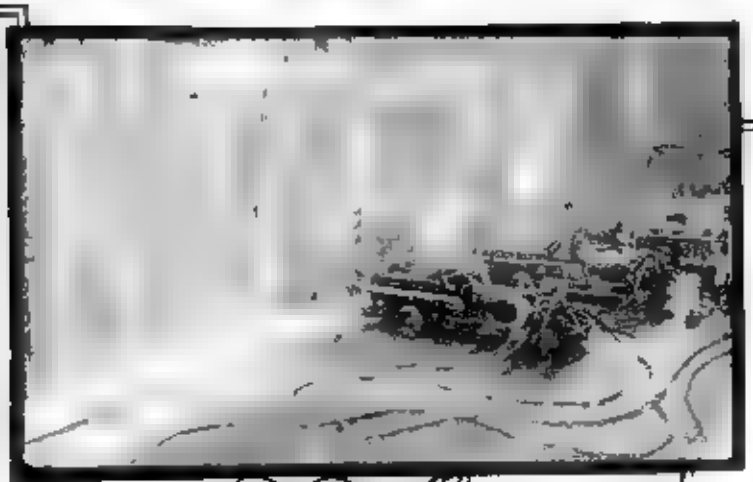
40 NON-TECHNICAL RADIO ARTICLES

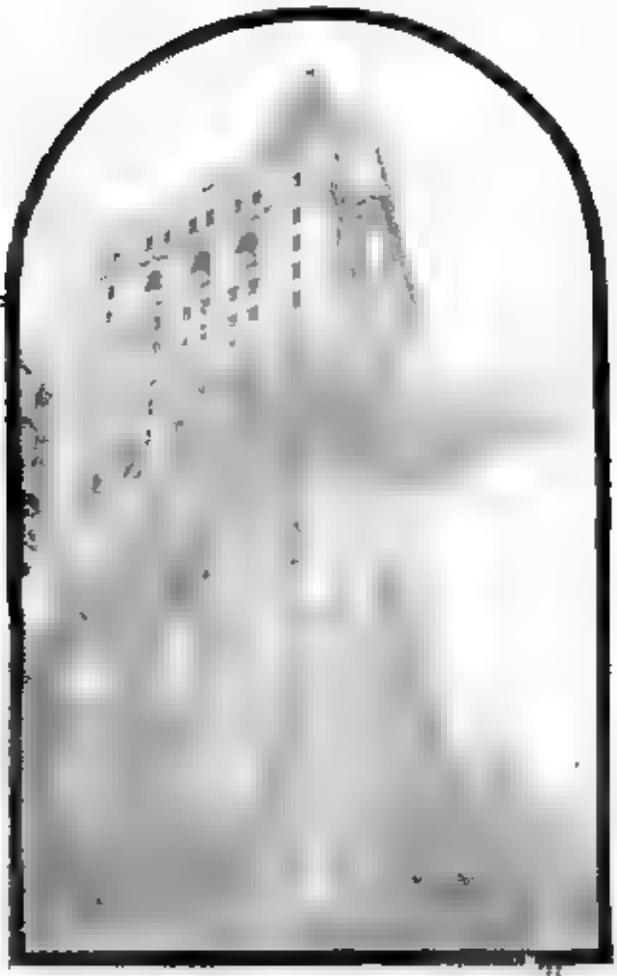
EXPERIMENTER PUBLISHING COMPANY NEW YORK PUBLISHERS OF
RADIO NEWS SCIENCE & INVENTION PRACTICAL ELECTRICS MOTOR CAMPER & TOURIST

# Fire Fighting

## Water Veil Protects Building

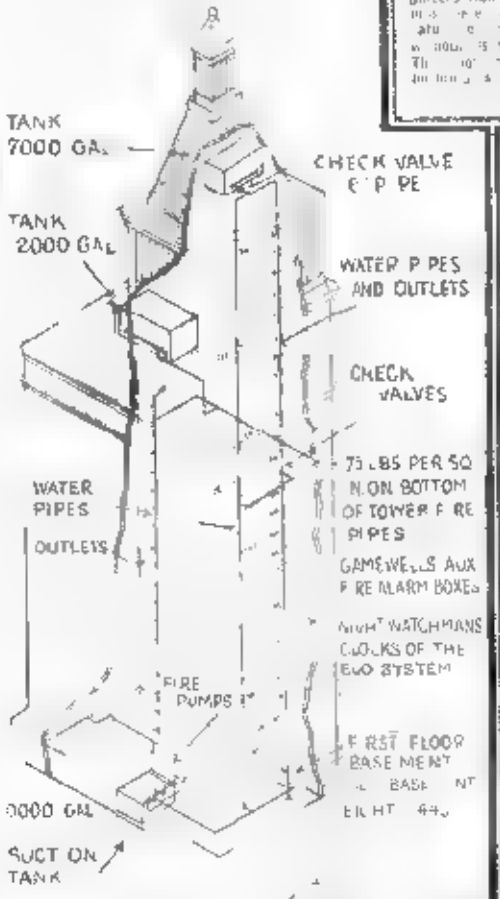
By R. G. THACKWELL





FIRE SYSTEM
92 WATCHMANS CLOCKS
49 FIRE ALARM BOXES
5000 FT. OF 1½" HOSE
100 FIRE EXTINGUISHERS
195 FT. OF STANDARD HOSE

By [illegible] automatic water [illegible] extinguishing [illegible] office building in Chicago [illegible] exposure fire [illegible] was [illegible] 1922 [illegible] 400 feet [illegible] street and damaged [illegible] several upper floors of a Chicago skyscraper. Engineers from Underwriters' Laboratories [illegible] the building [illegible] water [illegible] The [illegible] by the use of [illegible]

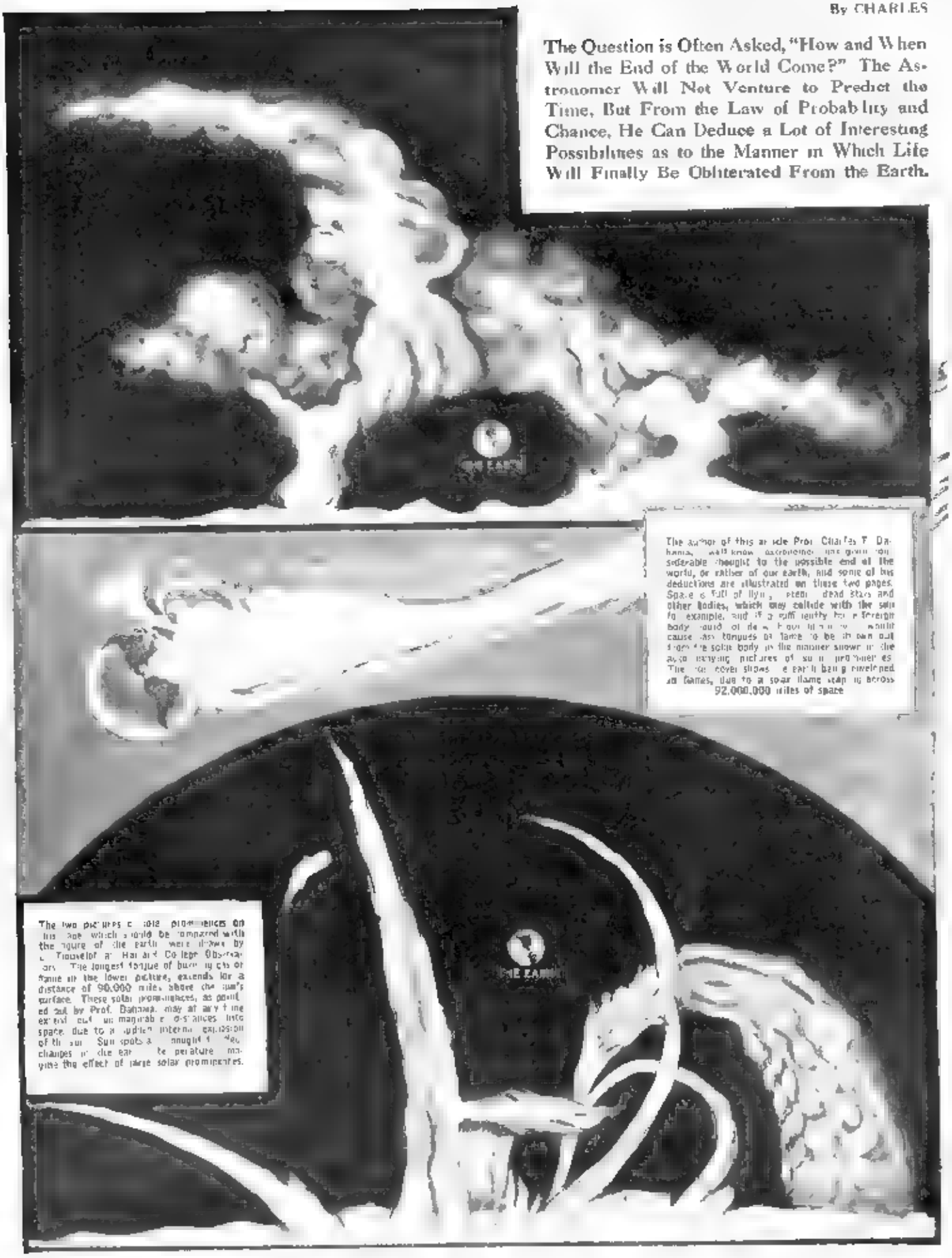


Pressure [illegible] the [illegible] pumps [illegible] small [illegible] of the building [illegible] the same [illegible] operated [illegible] 250 gallons of water [illegible] time [illegible] several [illegible] [illegible] at the [illegible] been [illegible] can [illegible] [illegible] of [illegible] wall [illegible] all [illegible] the [illegible] the [illegible] [illegible] from the street. Below [illegible] [illegible] [illegible]

# The End of

By CHARLES

**The Question is Often Asked, "How and When Will the End of the World Come?" The Astronomer Will Not Venture to Predict the Time, But From the Law of Probability and Chance, He Can Deduce a Lot of Interesting Possibilities as to the Manner in Which Life Will Finally Be Obliterated From the Earth.**



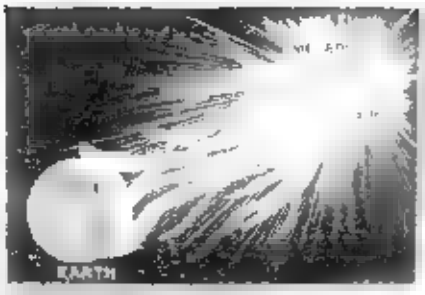
The author of this article Prof. Charles F. Dahms, well known astronomer, has given considerable thought to the possible end of the world, or rather of our earth, and some of his deductions are illustrated on these two pages. Space is full of flying stars, dead stars and other bodies, which may collide with the sun for example, and if a sufficiently large foreign body should do so it would undoubtedly cause such tongues of flame to be thrown out from the solar body as the manner shown in the accompanying pictures of such prominences. The top cover shows the earth being enveloped in flames, due to a solar flame leap in across 92,000,000 miles of space

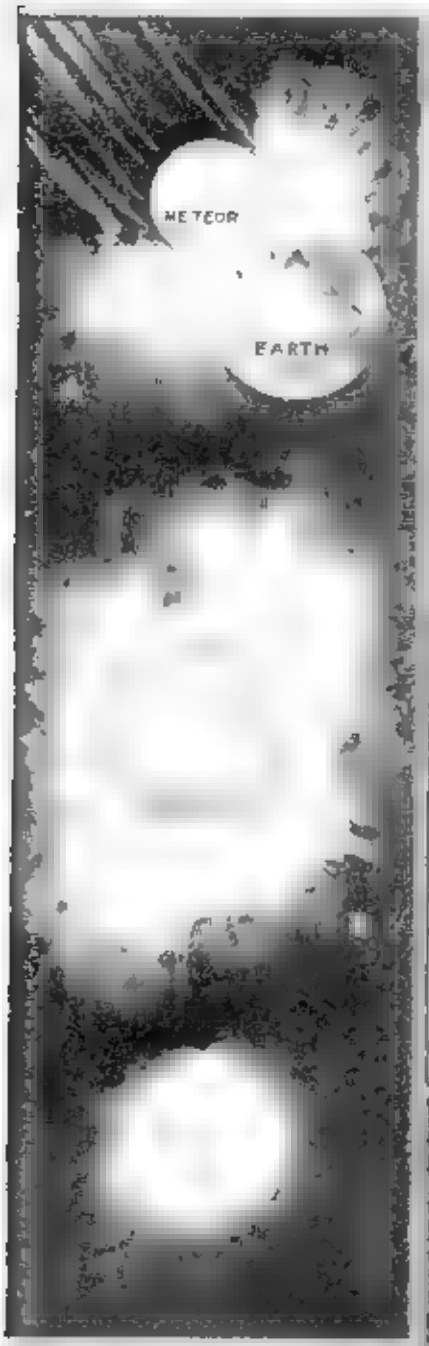
The two pictures of solar prominences on this page which should be compared with the figure of the earth were drawn by C. Trowbridge at Harvard College Observatory. The longest tongue of burning gas or flame in the lower picture, extends for a distance of 90,000 miles above the sun's surface. These solar prominences, as pointed out by Prof. Dahms, may at any time extend out an immeasurable distance into space due to a sudden internal explosion of the sun. Sun spots and unusual changes in the earth's temperature may give the effect of large solar prominences.

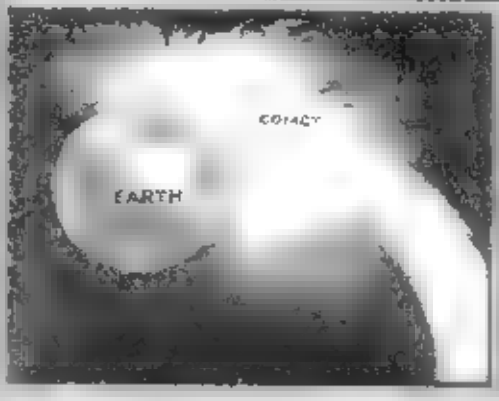
# the World

F. D'HARIA

**Life is a Gamble. Will the Sun Hit Another Star and Cause a World Cataclysm? The Astronomer Says This May Occur—Sometime Within the Space of 1,000,000,000,000,000,000 Years—But With That Length of Time Ahead of Us There is Small Chance of Its Ever Occurring Before Some Other End Befalls Us.**





The two pictures directly above show what would happen if a large comet containing as much matter as the earth should collide with the earth. Comets are not solid, but consist of a mass of gas, dust and meteors. The head of the comet would be a shapeless mass of molten metal covered with steam. (See C)

# Doctor Hackensaw's Secrets

## By CLEMENT FEZANDIÉ

### No. 29—AROUND THE WORLD IN EIGHTY HOURS

Everything being in readiness, Doctor Hackensaw through his interpreter informed the natives that he was under the special protection of their god Buddha and that Buddha himself would confirm this. Buddha's commands were uttered through the loud speaker, and a hush of awe fell over the hundreds of spectators.

#### PROLOGUE

"YES, Mr. Sharp, I'll guarantee these new airplanes of mine to make an average speed of over three hundred miles per hour, and to run more than ten hours without need of making a stop."

The speaker was Doctor Hackensaw and the person addressed was a blase-looking young man, whose high position in the government must have been due to strong political pull, as the man was evidently utterly unfit for the position he occupied. Here was Doctor Hackensaw offering to construct for the government a number of aircraft possessing a speed far greater than that of any machines hitherto constructed, and yet this self satisfied young fellow was refusing to listen to the proposal.

Finally the worthy doctor lost his temper. "Don't you realize, man," said he, "that what I am offering you is an opportunity to make our country the greatest military power in the world."

"I understand your offer all right," returned the young man, laughing. "But I strongly doubt your ability to deliver the goods. In other words, I don't believe your machine will do what you claim for it, and the country has no money to throw away on experiments."

"If that's all," cried Doctor Hackensaw eagerly, "I'll give you any demonstration you want and prove to you that my new airplanes will make three hundred miles an hour or more."

"Yes," returned the young fellow grinning, "perhaps they will for a few seconds or a few minutes, with the machine a complete wreck at the end of the experiment."

"No, indeed!" retorted the doctor warmly. "But tell me plainly. What test would you require? I'll agree to any test you ask."

"All right," replied the young man, his grin growing broader. "You say your machine will travel three hundred miles per hour. The distance around the earth is about twenty-five thousand miles, hence your machine ought to make the trip in eighty hours. When you have made the tour of the world in eighty hours I'll agree to order five hundred of the machines for the government. The only stipulation I make is that you make the experiment within the next hundred years or so, as I am afraid I may not be on the job longer than that." And the young fellow guffawed at his own wit.

"Very well, Mr. Sharp," replied Doctor Hackensaw, quickly, "I will accept your conditions, and instead of asking you a hundred years, I will agree to make the trip in a fortnight. I am not too old yet to vie with Jules Verne's Phineas Fogg and to accomplish in eighty hours what took him eighty days, and what took Nellie Bly almost as long."

#### CHAPTER I

"Doctor, what's this I hear?" cried Pep Perkins, bursting into Doctor Hackensaw's sanctum, unannounced as was her wont. "Is it true that you're going to make a trip all around the world in three days?"

(*Author's Note. When Jules Verne wrote his "Tour of the World in Eighty Days" the feat was impossible. Progress has been so rapid, however, that, unless this story is published at once, the journey around the world in eighty hours may be an accomplished fact before the story appears. As regards the special phonograph mentioned in the story, it should not be more difficult to make a phonographic record that will produce sounds unlike any known on earth than it is for an artist to draw a picture of things that never existed.*)

"A little more than three days," corrected the doctor, "in eighty hours, to be more exact."

"Gee! That will be dandy! Take me along with you, Doc. I'm just dying for some sort of excitement, and a trip around the world like that, will bring all the shutter-shooters around me, just as they follow Charlie Chaplin and Mary Pickford around."

"I'm sorry, Pep, but I can't take you along," replied the doctor, but the young girl, well aware of her power over the worthy man, pretended not to hear the refusal. "How many places will we stop at, on the way?" she asked.

"I shall try to make only seven stops, or eight if you count our landing here in New York on the return—I shall try to arrange a stop every three thousand miles or so. I expect my first stop to be in Paris, the next possibly in Cairo, the third in India, the fourth in Western China, the Fifth in Japan, the sixth in Hawaii, the seventh in San Francisco and the last back here in Hotel New York." Of course, in each place, I shall only stop long enough to get a fresh machine with supplies, for there will be no time to lose. Moreover, to guard against accidents and emergencies, I shall have extra machines waiting for me every five hundred miles of the course, even on the ocean, where the machines will be waiting for me on board ships whose exact location I can ascertain by wireless."

#### UNKNOWN SOUNDS

"What's that funny phonograph you're working on, now?" asked Pep. "Has that got anything to do with the trip?"

"No, nothing whatever," replied the doctor, little dreaming the service the phonograph was destined to render him. "This is just a new invention of mine. I am making some experiments at present with artificial phonograph records."

"What do you mean by artificial records?" asked Pep.

"Well, you see, an ordinary phonograph reproduces real sounds. My new phonograph produces sounds that have not been made and that never existed."

"How do you manage it?"

"Simply enough. An artist draws pictures of things that exist only in his own imagination. I do the same thing for sounds."

"Cut out the josh, doctor, and tell me straight. I don't understand what you mean."

"All right, Pep. You know of course that when you speak into a phonograph in making a record, the needle, or stylus as it is called, cuts a groove into the wax. It is the shape and size of this groove that regulates the sounds that the phonograph afterwards reproduces. Now, it struck me that it would be possible to make phonographic records by merely cutting the proper grooves without having to make the sounds."

"What would be the use of that even if you could do it?" asked the young lady, taking the chewing gum out of her mouth and fastening it beneath the seat of her chair.

"It would have a great number of uses," replied the doctor. "To begin with, it would enable us to repair records. Many remarkable records by famous persons are spoiled in the taking by some slight accident, and

are worthless. A slight repair to the injured portion would give us many wonderful records. My invention will also enable me to produce records that could not possibly be obtained otherwise. For example, the best soprano cannot sing above a certain key. I can, however, edit records that will produce clear musical notes octaves above any yet sung."

"But the grooves on a phonograph record are so small!" objected Pep.

### MECHANICS OF IT

"True. There were certainly mechanical difficulties, but I have solved most of them. In order to cut accurate grooves all that was necessary was to cut them on a large scale, and then reduce them. Of course, I had first to take an ordinary record, magnify it to many times its original size and get an expert engraver to copy the enlarged grooves in a hard-rubber block. Then, by means of a reducing pantograph, these enlarged grooves were cut into a wax disk at the original size and this engraved record made a very good copy of the original.

"I soon realized, however, that I must find a mechanical means for making the enlargement as well as the reduction, and I found the pantograph would serve the same purpose. To the short arm of the pantograph I attached a reproducer and to the long arm a recorder. When the reproducer needle traveled in the grooves of the original record the recording needle cut grooves, many times the size, on an immense wax disk.

"Before this I had tried enlarging the grooves by using a loud speaker, but I soon found that the depth of a groove made by a loud noise, is very little more than that of one made by a low sound.

"The next step, of course, was to engrave a large record without any model. To obtain satisfactory results, it was necessary to analyze ordinary records in order to discover what connection existed between the grooves and the sounds produced. To do this, I hired a man with very clear articulation to make an ordinary phonograph record of every vowel and consonant sound in the language. I enlarged these records and thus found what shape of groove would produce each letter. My engraver could then produce any sentence I desired by combining the grooves in the proper order to make the sounds. I studied pitch in the same way. A record would be made of a couple of octaves either sung or played on a musical instrument, and a study of the enlarged record showed me what modifications in the shape of the groove produced pitch. Similar studies were necessary to obtain the proper quality and overtones. My first results were promising, but very crude. It was only when I used chemical engraving instead of mechanical engraving that I obtained real satisfaction."

He telephoned the order to the three pilots. The machines started upward and very quickly rose to an unprecedented height of five miles. For an hour they continued thus, with a speed that exceeded four hundred miles per hour.

"Chemical engraving?"

"Yes. What are called photoplates. For example, to reduce my large engravings to the proper size, I photograph them on a metal disk coated with sensitized film. On developing, the parts which receive the high lights retain the thinnest coating, and when etched with acid produce the deepest grooves. In other words my *negative* is reversed, and if played on the phonograph would give sounds utterly unlike the original. It is therefore necessary to make a *positive* by repeating the process from the negative. The grooves, thus reversed back again, will now produce the proper sound. I am now able to make records that will produce any imaginable or unimaginable sounds. When I want a thunderstorm or a roar of artillery I don't have to wait for Nature or man to supply me. My engraver cuts the grooves we have found will give the proper sounds, and the process is quiet and easy.

"But I'm wasting time. If you're bound on coming with me, I suppose you'll come, but you've only got two weeks to get ready in—only two weeks to collect a supply of face-powder sufficient for the eighty hour trip!"

Pep laughed and began at once to pack up, and not content with face-powder she prepared a whole trunkful of evening dresses in order to be ready for any emergency. As she remarked: "You never know what will happen when you travel with Doctor Hackensaw. He's a philosopher, and a philosopher is a man who can take care of the whole world, but can't be trusted to look after his own collar-buttons."

### CHAPTER II

"Well, Pep, are you all ready?"

"Yes, I'm ready."

"Then jump on board and we'll start off for our tour around the world. Mr. Shard is now five minutes to ten, and the date is August 15th. We have a fine morning for the start, so I shall leave here at the stroke of ten. If you will kindly sign your name in my book here, I will have your agents at the different stopping places sign too, so that you can know there is no fake and that I have really traveled all around the earth. Otherwise you might imagine I had just flown to the nearest "hooteh" station and back again. Well, good-bye, I'll be back for the week end."

So saying, Doctor Hackensaw followed Pep into the airplane that was waiting for them—the "Hoochie," as it was named, after his little girl.

The Hoochie was a large and very peculiar-looking craft. It looked more like an arrow than it did like an airplane, for its wings were quite narrow for the size of the machine and in addition to the horizontal wings, there were two vertical ones, one on top and one below, like the fins of a fish, and designed to keep the plane from wobbling in its flight. The machine had eight propellers, two in the rear, two in front, one on each side, and two on top that could serve as helicopters when desired, to hold the machine stationary, for they could be swung through an angle of ninety degrees, from a vertical to a horizontal position. Four engines of five-hundred horsepower each, ran the propellers and could be switched to any or all of the propellers by an ingenious gear shift worked by pressing electric buttons. The entire fuselage, including the pilot-seat, was enclosed in a glass body protected by an outer metallic casing. Any portion of the metal casing could be opened at will, thus allowing the passengers to view objects outside, no matter where these happened to be situated. An external platform made repair work handy and facilitated entering and leaving the car. This was also convenient for observations when the car was hovering over one spot.

The Hoochie was a large and very peculiar-looking craft. It looked more like an arrow than it did like an airplane, for its wings were quite narrow for the size of the machine, and in addition to the horizontal wings there were two vertical ones, one on top and one below, like the fins of a fish, and designed to keep the plane from wobbling in its flight.

At the stroke of ten the doctor snugly ensconsed in the car with his fair companion, gave the signal, and away shot the car, buried by its projector. Meanwhile the engines had been chugging away but almost noiselessly as they were provided with silencers. Now, however, the propellers were thrown into gear, and forward darted the machine, climbing diagonally up into the sky.

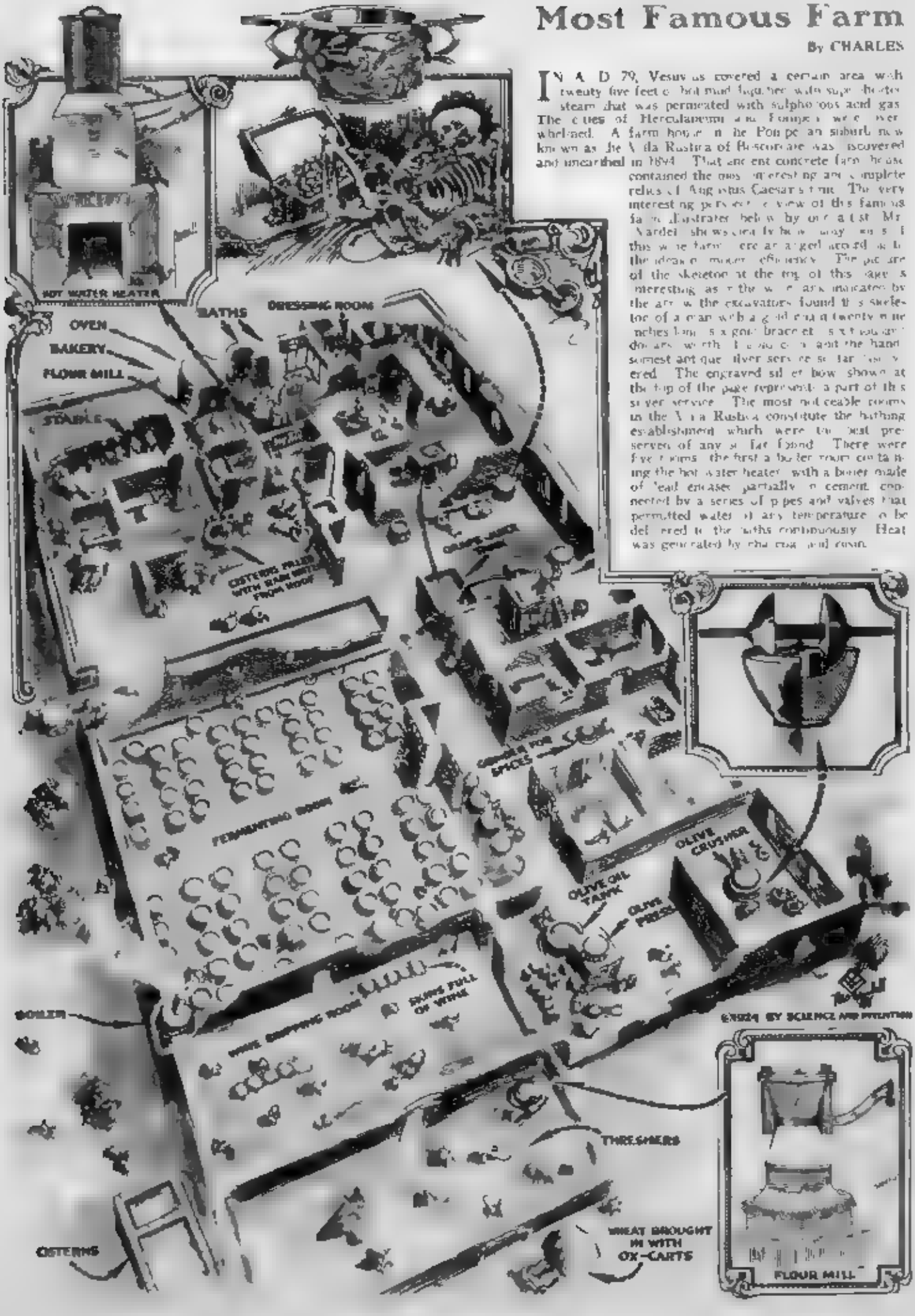
"What are those two other planes that are following us?" asked Pep, looking out through the glass window and noticing that two other machines very similar in build, had followed them into the air.

(*Continued on page 212*)

# Most Famous Farm

By CHARLES

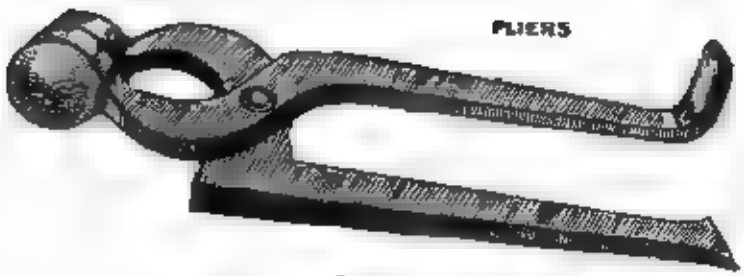
IN A. D. 79, Vesuvius covered a certain area with twenty-five feet of hot mud, ashes and superheated steam that was permeated with sulphurous acid gas. The cities of Herculaneum and Pompeii were overwhelmed. A farm house in the Pompeian suburb now known as the Villa Rustica of Boscoreale was discovered and unearthed in 1894. That ancient concrete farm house contained the most interesting and complete relics of Augustus Caesar's time. The very interesting perspective view of this famous farm illustrated below by our artist Mr. Nardelli shows vividly how many wonderful things were carried on in the ideal farm house of the most efficient. The picture of the skeleton at the top of this page is interesting as it is the one that indicates by the arm where the excavators found this skeleton of a man with a gold ring, twenty-nine inches long, six gold bracelets, six hundred and forty-six gold coins and the handsomest antique silver service so far discovered. The engraved silver bowl shown at the top of the page represents a part of this silver service. The most noticeable rooms in the Villa Rustica constitute the bathing establishment which were the best preserved of any so far found. There were five rooms, the first a boiler room containing the hot water heater with a boiler made of lead encased partially in cement, connected by a series of pipes and valves that permitted water of any temperature to be delivered to the baths continuously. Heat was generated by charcoal and coal.

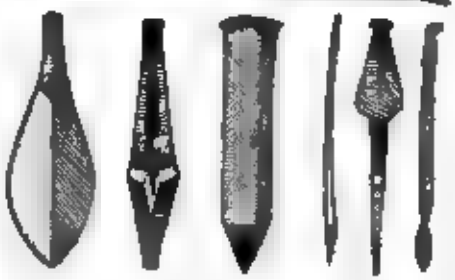


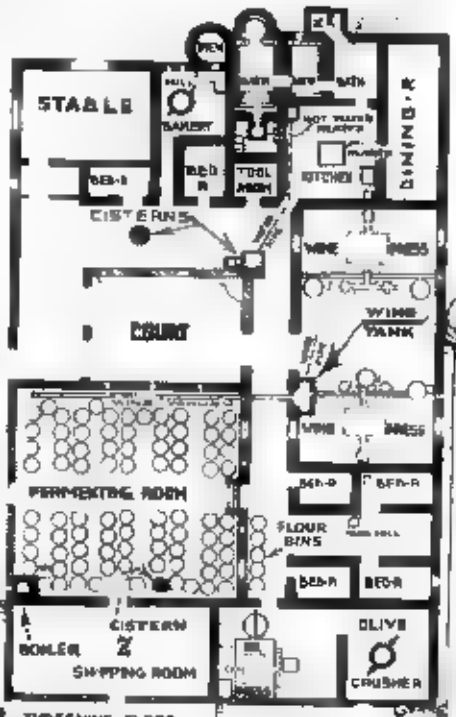
# Of All Antiquity

B. BUNNELL

THE floor plan of the Villa Rustica of Boscoreale shown here gives a good idea of the efficient arrangement of this famous wine farm. Continuing our descriptive story from the preceding page, we find next to the bath establishment an interesting bakery, which was equipped with an efficient oven and flour mill. By far the most extensive department was the fermenting room with its eighty-three doliums (earthenware wine containers) that held five thousand gallons of wine in process. It was also provided with a cistern and lead boiler. Romans mixed hot water with wine and the vase used in that capacity was a more costly affair than the average saloon of today. The Frenzy Wine produced a headache that lasted thirty-six hours. The press room housed two wine presses, whose output fell into three round tanks and one rectangular one, which in turn delivered it through a trough to the fermenting room, where it was troughed to the designated dolium. The shipping room adjoins the fermenting room, and here the wine was filled into skins, and thence distributed to wine shops in Pompeii. The threshing floor adjoined the fermenting room. Olive oil was made on one press in a room by itself, and the olives were crushed in the olive crusher shown on the opposite page; this device stripped off the skins without cracking the pits. The hand-mill in the room by itself was used to grind spices and pepper. In outline it resembled the flour mill shown on opposite page, in size it was smaller.

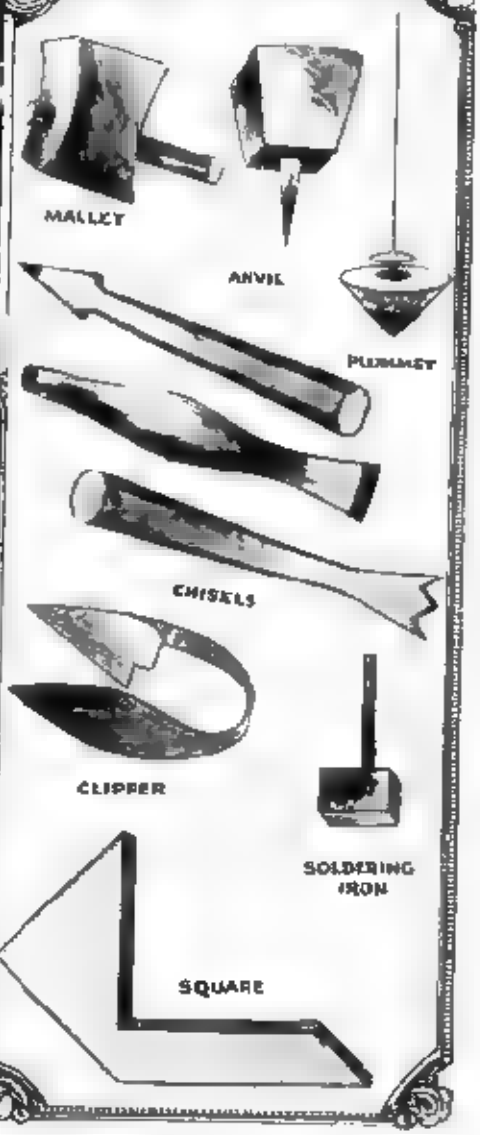


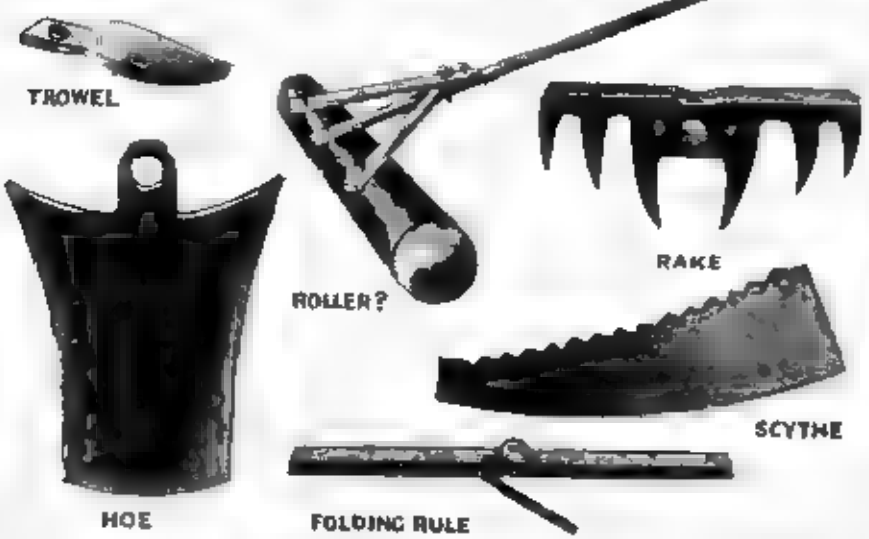




FLOOR PLAN OF BOSCOREALE FARM A.D. 79

The tool room of this antique farm boasted of many interesting specimens. Here were found many scythes with teeth, and assorted remains of tools. Roman tools from Herculaneum and Pompeii are number so many that we have illustrated some representative ones. The Roman plow resembles the plow of today with the exception that their beam was straight while ours is curved. Their guide wheel was fixed—ours is adjustable. The Greek plow used by Romans was different in all respects. It was said to have been invented by the Goddess Demeter, who in attributes resembles Ceres. The tools shown below include a roller of peculiar design and a folding Roman rule.

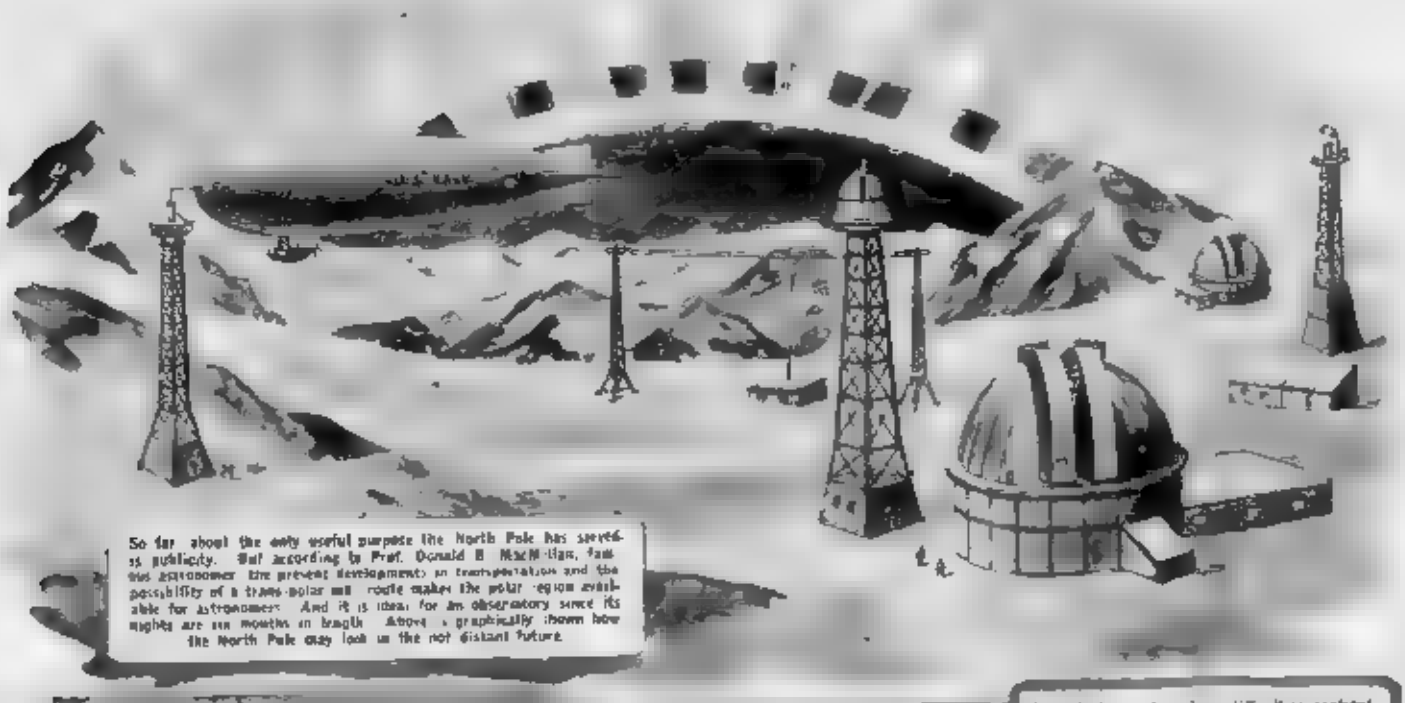


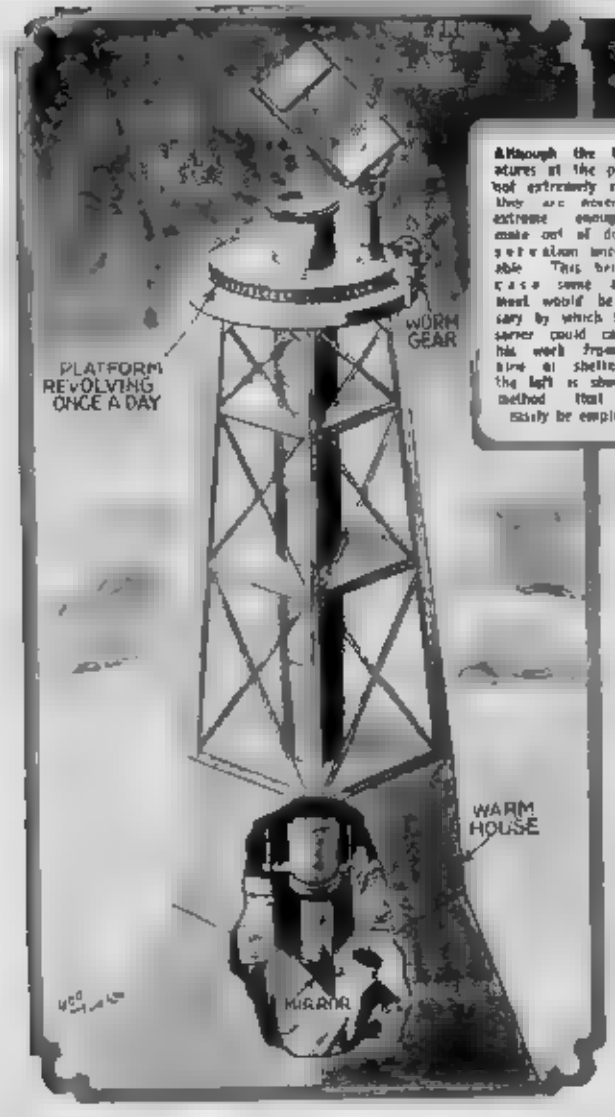

The illustrations above as well as to the left show some of the clever ideas followed in tool-making over 2,000 years ago. Engraved gems show blacksmiths working with hammers just as it does today. These gems also show drillers at work. Paintings from Pompeii show a saw of the type of that used in New England today. Another gem shows a modern sand. Weaving with a bobbin, as now employed on numerous sewing machines, is illustrated on a Roman vase. Children rolling a hoop is agraved on gems, and in fact the Romans left us enough illustrations upon all subjects to fill any ordinary library. With the 100,000 objects excavated from Pompeii alone, their lives and their life histories are known with considerable certainty.

# Observatory at North Pole

By CHARLES T DAHAMA

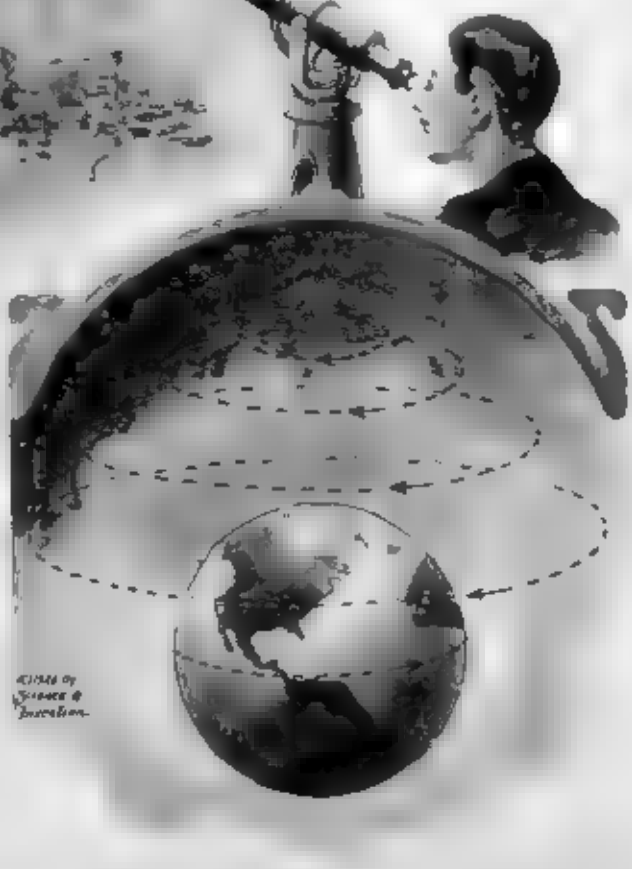


So far about the only useful purpose the North Pole has served is publicity. But according to Prof. Donald B MacMillan, famous astronomer the present development in transportation and the possibility of a trans-polar mail route makes the polar region available for astronomers. And it is ideal for an observatory since its nights are six months in length. Above is graphically shown how the North Pole may look in the not distant future.




Although the temperatures at the pole are not extremely rigorous they are nevertheless extreme enough to make out of door observation uncomfortable. This being the case some arrangement would be necessary by which the observer could carry on his work from warm hive of shelter. At the left is shown one method that could easily be employed.

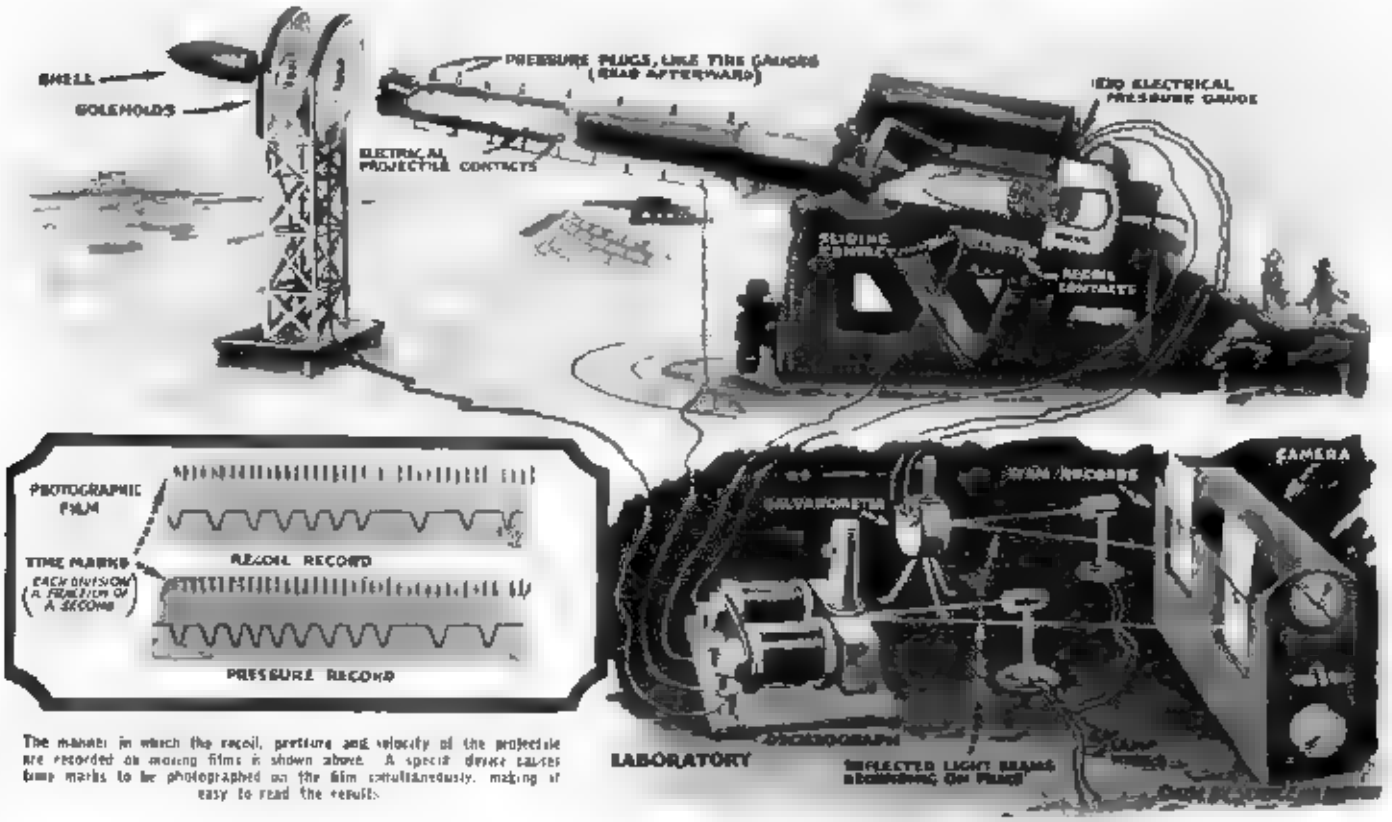
One of the most serious difficulties confronting astronomers in the temperate zones is the effect of the sun's rays on oxygen in the atmosphere. The rays change the oxygen into ozone which is practically opaque to the waves at the ultra-violet end of the spectrum. The North Pole observatory will alleviate this, the sun will be set for long periods and ozone will disappear shortly after sunset.



At the North Pole all the stars would travel around the earth in circles, never going below the horizon. Observations would never be interrupted by sunrise. Photographic exposures could go on as long as necessary. In the temperate zones after sunset each day the observer is troubled by the continuous rise of heat rays which tend to distort the image formed in telescope. This is a handicap that would be overcome by the observatory. At the right is shown the circular path of stars at the pole.

# Testing Cannons by Electricity

By RAYMOND FRANCIS YATES




The manner in which the recoil, pressure and velocity of the projectile are recorded on moving films is shown above. A special device causes time marks to be photographed on the film simultaneously, making it easy to read the results.

Big gun experts have always wanted to know just what happened inside a cannon at the very moment of explosion. The apparatus here shown—and perfected at the Aberdeen Proving Grounds—accomplishes this work. In the breech of the gun, there is placed a piezo-electric gauge, the shock of explosion causing a static electric charge to be produced on quartz crystals. This electric charge registers on a ballistic galvanometer and the result is recorded upon a moving photographic film as shown in the picture. Electrical recording devices register the amount of recoil, and the velocity of the projectile. Individual pressure gauges are inserted along the gun barrel.

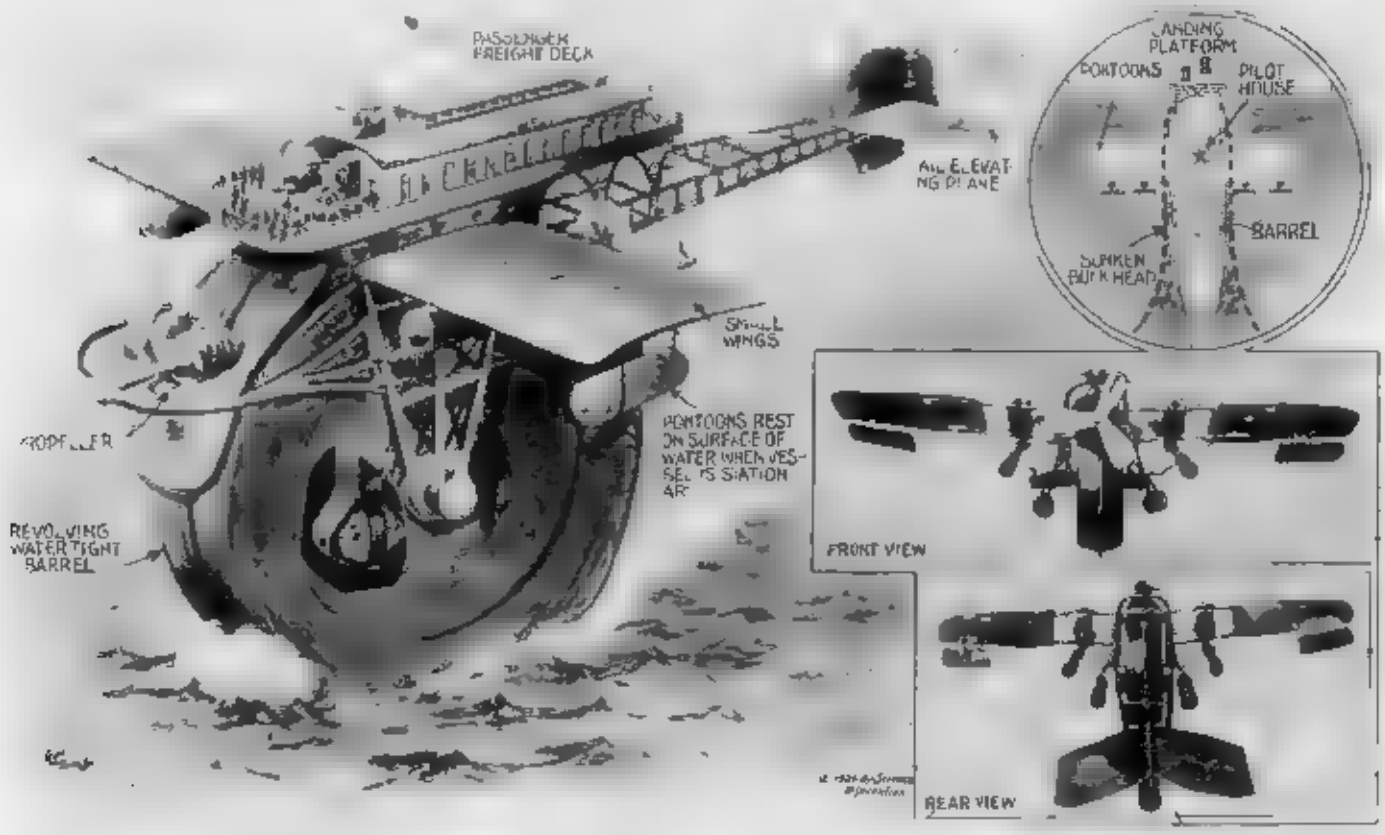
# Human "Lightning Calculator"

Even with modern adding, subtracting and multiplying machines the speed of Mr. Sullivan (shown in the pictures herewith, and in two of the views with Professor Joseph Quinniger) cannot be beaten. An illustration of this is given below. Two numbers were given to Mr. Sullivan, that is to say a figure under a hundred was told him. He was to give the square and cube of this number. The complete answer was returned in four and three-quarter seconds from the time the number was mentioned, all calculation done by him being mental.

The figures on the slate above were arbitrarily put down by a spectator. These were held by Mr. Sullivan as shown. The total however was not on the slate. Calling up his left hand so that the figures were upside down, he glanced at them. The duration of the glance was one and three quarters seconds. Thereupon the total was immediately called back and found to be correct. Do you suppose that you could add a column of figures of this nature after glancing at them for one and three quarters seconds, even if they were in an upright position?

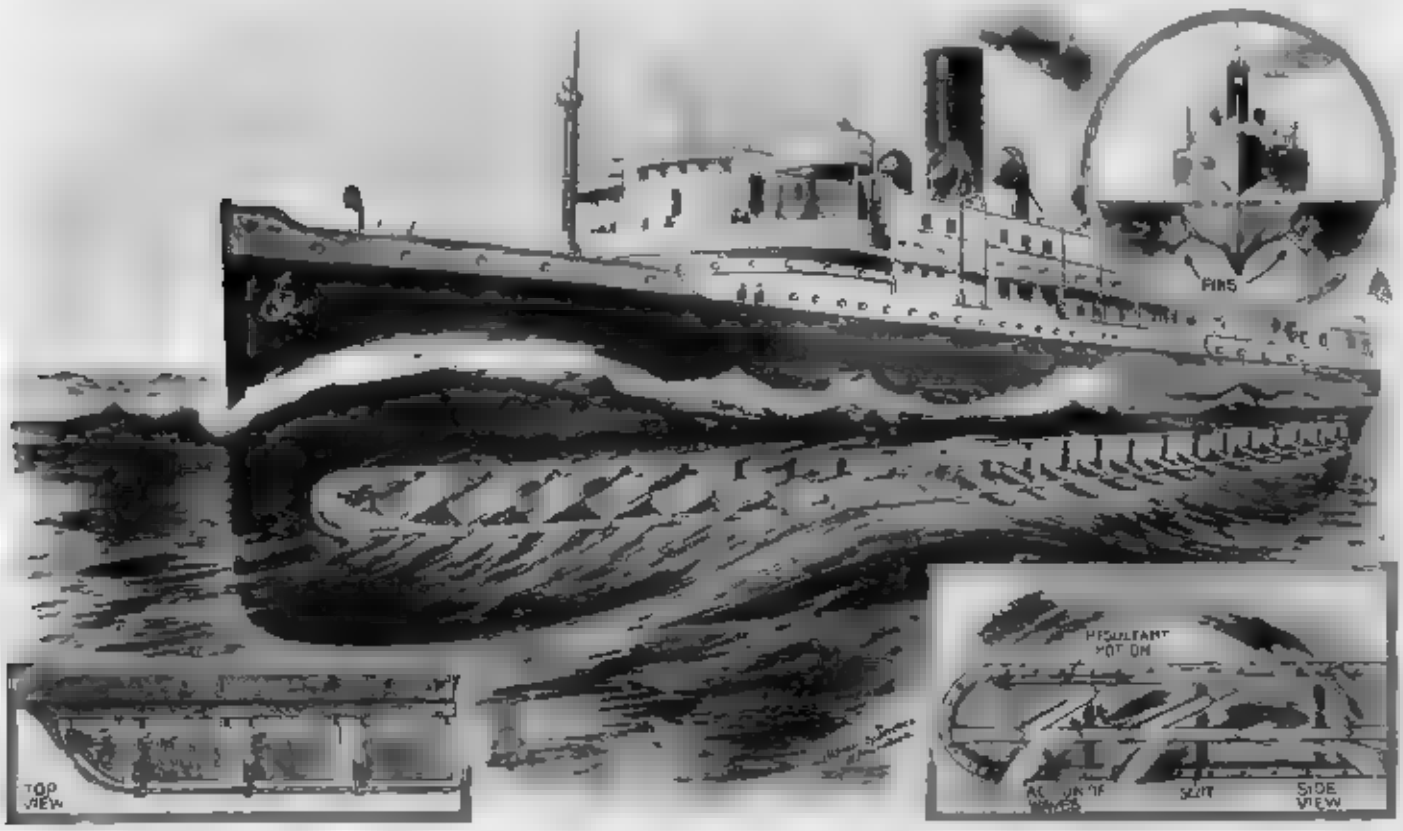
Eight figures were placed on the slate as shown in the photo below. Mr. Sullivan looked at the figures for two-fifths of a second. He called them back in order from left to right and again repeated from right to left in three and three-fifths seconds. Mr. Sullivan cannot account for his phenomenal speed in figures. He can multiply three numbers by three others mentally and invariably produce the correct answer. In a test in the freight yards, Mr. Sullivan was able to remember the numbers on twenty cars as they passed him and was able to call them back and mention each and every road designation.

# 150 Miles Per Hour In Speed Ferry




The new type of ferry boat seen in the illustration above will be able to attain a speed of 150 miles an hour. The circular hull revolves upon the stationary axle. In the hull a gyroscope is mounted to steady the vessel when it is not moving forward. As the speed increases the vessel rises almost completely out of water, when nearly all of the pontoons rest on the surface. The water-cut automobile is by means of propellers. Photos show model of a Cox

# Increasing Liners' Speed




The operation of the system illustrated above, it is seen that fins may greatly increase the speed of large ocean liners by placing them on the side of the vessel in the manner shown. The fins have a limited motion under upward or downward pressure of the water and upon the fins they move freely so the form of the space between them. Thereafter the energy of the water striking the blades produces a resultant forward motion. P. Hagensen

# The World's Bigness In Figures

## Massiveness of Totality

By DR. RUSSELL G. HARRIS,
Harvard University.

THE only method through which the ultra-large figures of the universe may be appreciated is to divide them into multiples familiar to every-day life. Some of these figures are shown here. Interstellar space appears at the top.

By far the most interesting thing in the new physics is the atom with its electrons. These small particles go to make up molecules. If we should tag each of the molecules in a tumbler of sea water we should need more than a million million million million tags (1,000,000,000,000,000,000,000,000). If we should pour the tagged molecules back into the ocean to be mixed thoroughly and then take another glass of water from the ocean anywhere, we should draw out more than 2,000,000 of our tagged molecules.

Some idea as to the number of people on the world and the space they would occupy as standing room is illustrated in the three center illustrations. The amount of the earth, if equally divided, that would fall to each inhabitant is illustrated at the left. There would be enough gold and platinum in each division to make each a millionaire.

The energy of sunlight as depicted below

Sept

25 Cents

# Science and Invention

IN PICTURES

FLAME THROWER
PROTECTS EXPLORERS

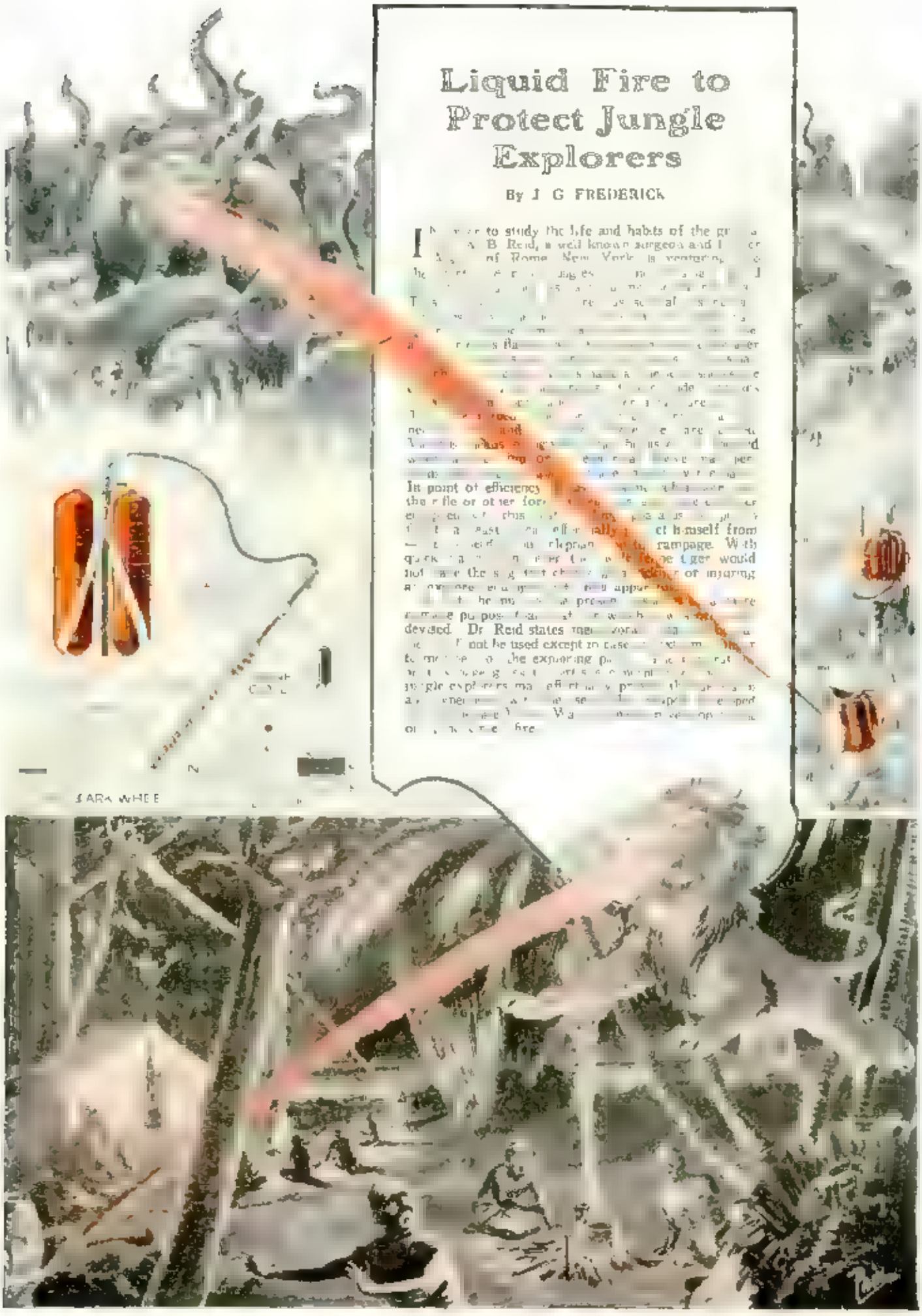
See Page 446

40 NON-TECHNICAL RADIO ARTICLES

RADIO NEWS | SCIENCE & INVENTION | PRACTICAL ELECTRICS | MOTOR CAMPER & TOURIST

# Liquid Fire to Protect Jungle Explorers

By J. G. FREDERICK



# At Last! Real Wind Power

By C. A. OLDROYD, A. E.

The problem of cheap wind seems, at last, to be succumbing to the constant work of scientists. A Danish engineer has just brought forward the design of a wind electric plant which uses a tank of water as a method of storing the power taken from the wind. The wind pumps the water into the tank on the hill-top and when current is needed the water is allowed to flow through the turbines at the bottom of the hill, generating current.



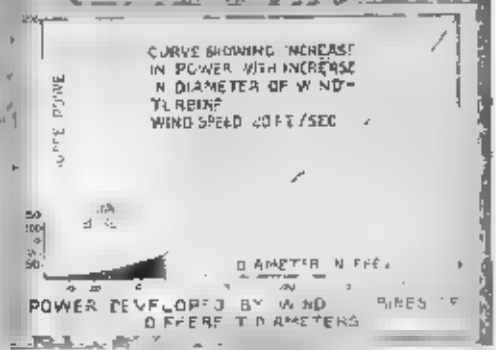
Above and at the right are shown two views of the novel wind mill used by the Danish engineer. The new idea in wing construction will at once be noticed. The insert above and to the right shows a cross section of one of the arms, which is very similar to the cross-section of an aeroplane wing. Only six arms are used to the unit for the sake of efficiency.





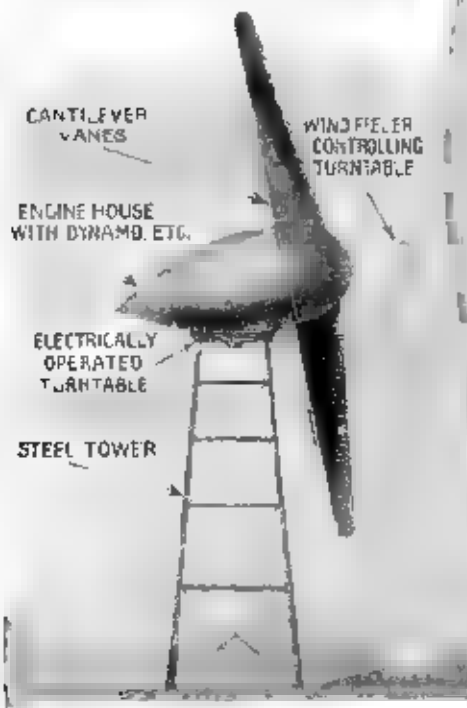


DIAGRAM OF WIND WATER ELECTRICITY SCHEME

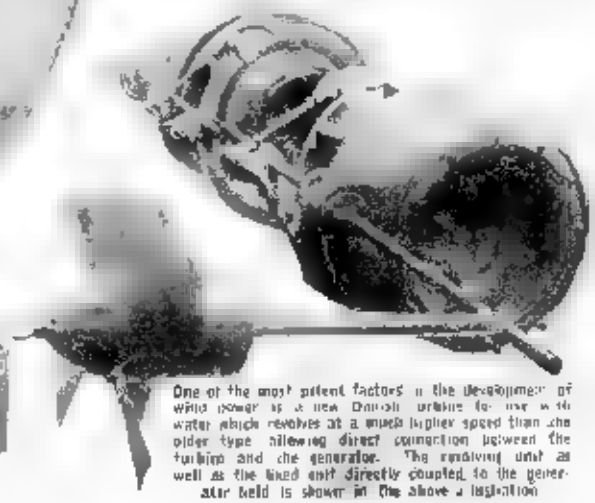



POWER DEVELOPED BY WIND TURBINES OF DIFFERENT DIAMETERS

The curve diagram above shows the remarkable increase in horse-power as the diameter of the wings increases. Fifty feet is about the largest diameter wind mill that has been constructed to date. The larger the mills are made, the greater is the proportional increase in horse-power. Above the curve are shown the various stations through which the power is carried in this system of developing electricity from the wind. The wind pumps the water through an electric pump to the top of the hill. The water is led from the tank to the turbines as needed, and the turbines drive generators, giving electric power for distribution to consumers.



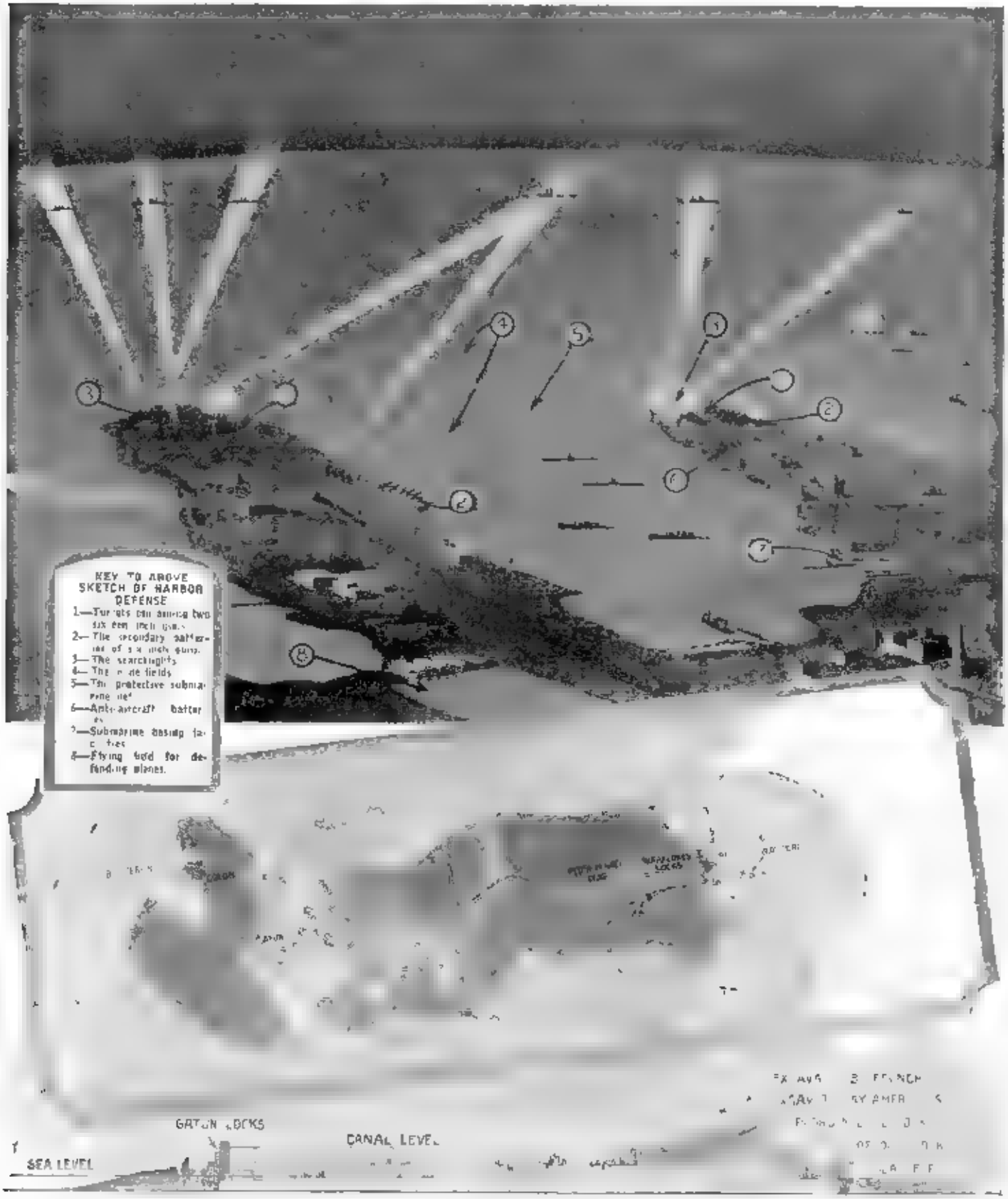

Above is shown a more advanced engineering design giving a probable future form of the big wind engine. The blades are cantilever type with no wires or bracing struts exposed. A wind feeler control the shaft of the machine towards the wind. The blades are attached directly to the front end of the bearing, which revolves with them. The rear of the housing contains an electric generator connected direct by or through gears to the shaft. The whole affair is streamlined. The position of the machine is changed by an electrically driven turn table which works automatically.



One of the most potent factors in the development of wind power is a new Danish turbine to use with water which revolves at a much higher speed than the older type, allowing direct connection between the turbine and the generator. The revolving unit as well as the fixed unit directly coupled to the generator field is shown in the above illustration.

# Can Panama Canal Be Defended?

By GRASER SCHORNSTHEIMER, Staff Naval Editor

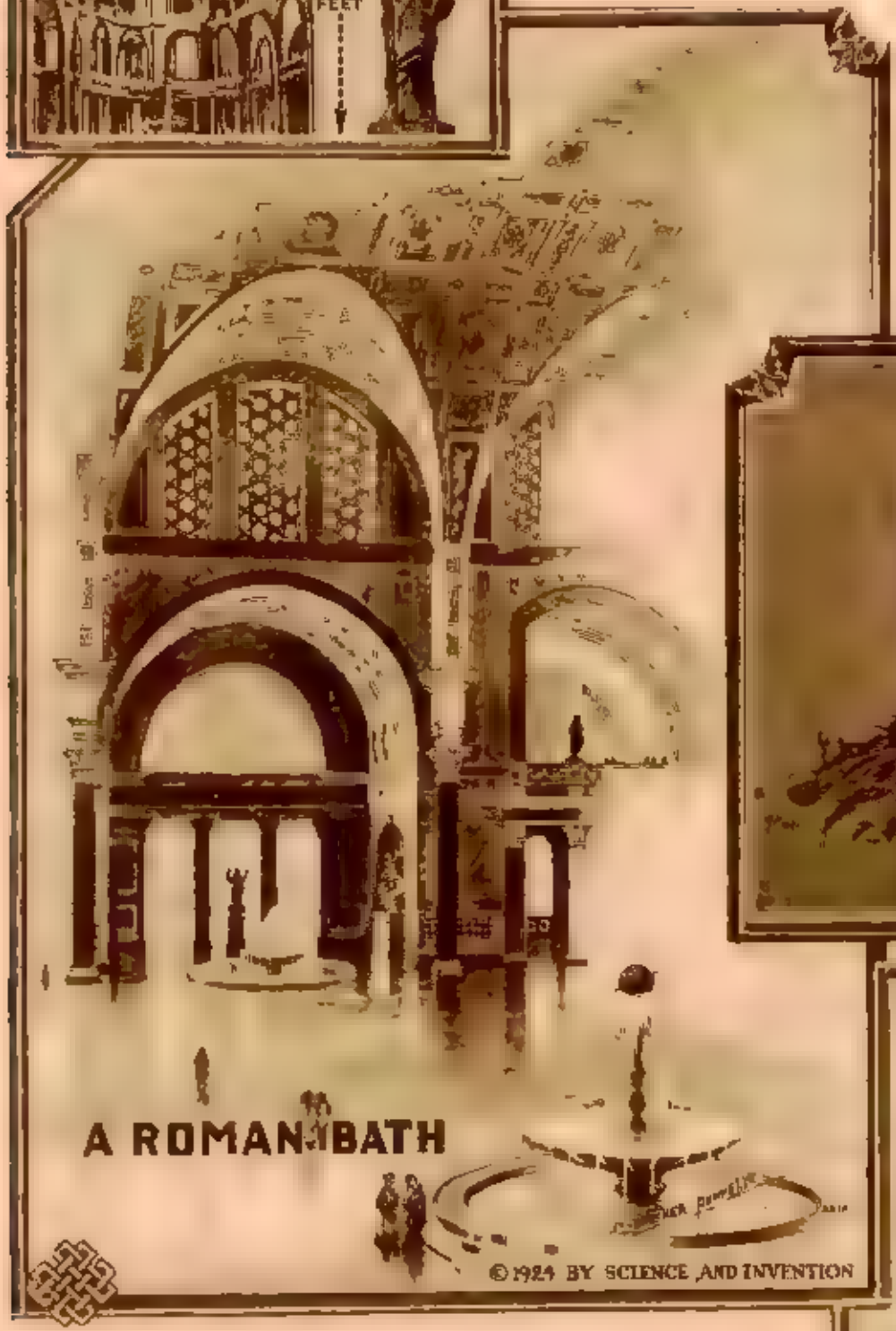


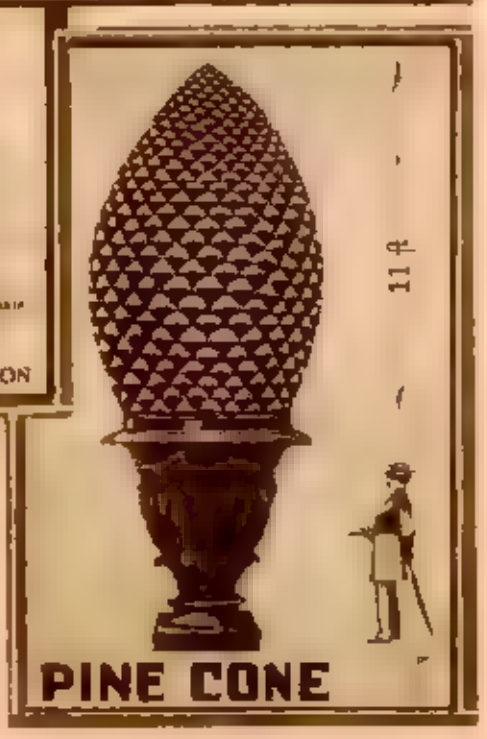

AUTHORITIES have recently stated that the Panama Canal should be brought to sea level for the sake of fortification. However, the Panama Canal is a weak point in the national defense because the approaches and entrances are antiquated. The sketch at the top of the page with the key gives an idea of the procedure in a naval battle when the forts are notified of the presence of enemy vessels near the entrance. Searchlight batteries immediately seek out the vessels. The heaviest artillery is then turned on them and fire is opened. Small seagoing craft of the enemy fleet usually attempt to come in close, under cover of smoke, and fire at the searchlight batteries and other important units. The smoke screen very often finds its chief use at this point. Adequate airplane observation, however, makes the smoke screen worse than useless since the planes may observe the movements of the enemy's ships from above. Should the water mandatory front of the forts be protected from submarine and other small craft by mine fields and nets. The sketch also graphically shows how the old 12" and 14" caliber guns, which at present line the canal for distances might be easily replaced by 16" guns and better armament of present day navies. This has been done for perfect protection of the canal is not bringing it to sea level but the installation of adequate artillery and perfect protection of the present fortresses. The cross section shown at the bottom of the page gives a very clear idea of the huge amount of work that would be necessitated in bringing the canal to sea level.

# Wonderful Old Roman

By CHARLES

At the left above is a comparison of the bath with the Statue of Liberty below is the famous Pine Cone, which stands in a half dome building overlooking the beautiful Vatican Gardens. From each of the petals a stream of water issued. It originally stood on an island centerpiece in the midst of an artificial lake of the Campus Martius Around it was a whole bed of artificial flowers and plants wrought in bronze. The Pine Cone is still in perfect condition, though it is no longer the centerpiece of a fountain. Some of the flowers have also been retained



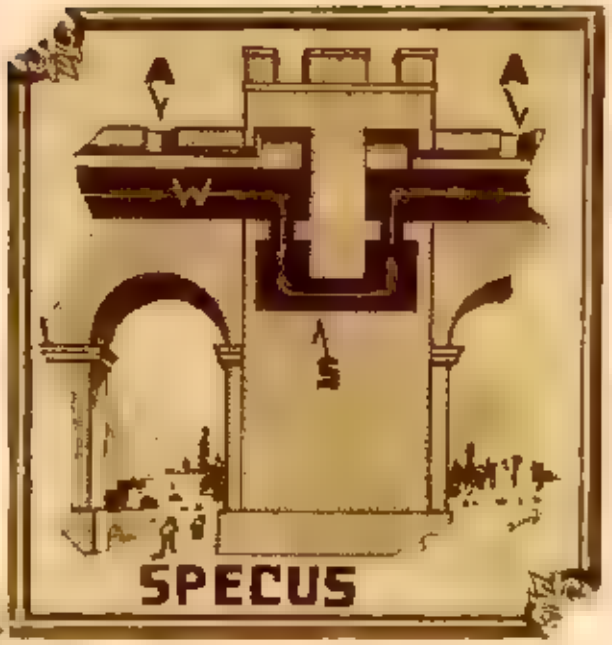



Not only do the Roman baths represent one of the highest points in their building but the buildings themselves developed a style of architecture and a grandeur which is rivaled in very few places today. One of the large railroad terminals in New York City follows directly its style of architecture. Above we see the interior of Carcella's bath. It was forty-nine feet higher than the Statue of Liberty, and one hundred and fifty feet higher than Cleopatra's needle. This was one of the most sumptuous buildings ever constructed by man. Marble from Egypt, of various colors, was used for the entire interior facing of the building, while the arches and ceilings were covered with mosaic pictures, statuary of glass, ivory, bronze and gold was scattered promiscuously throughout. Through the central arch we see the beginning of the cold bath, and to the right through the sectional arch one of the warm baths for women. There was also a library, lecture room, theatre and gymnasium

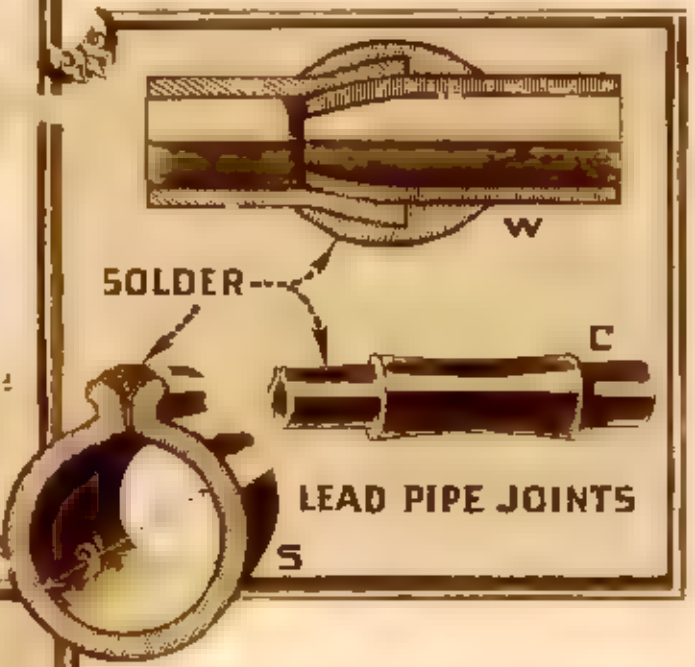
# Baths and Water Systems

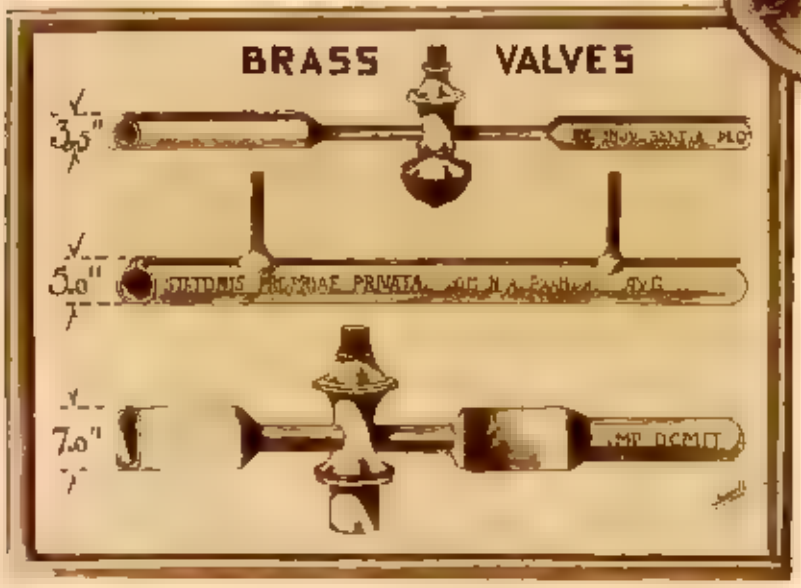
BEECHER BUNNELL

Since there were more than six hundred Roman baths, such as those described on the opposite page, millions of gallons of water were necessary to keep them in operation. Much of this water was carried over the city in aqueducts, one of which is shown below. The section shown in the illustration below stands near Nemausus still in almost perfect repair. It is one hundred and sixty-eight feet high. There was also a passage on the lower level for men and vehicles. The whole arcade was built of stone and brick and supported entirely by the arch work. This is only one of a dozen or so aqueducts which helped carry Rome's great supply of water. A gravity system transported the water in practically all cases. The valve system for protection used in these aqueducts, is shown in the sketch to the right. There was a strip thirty feet wide on either side of the aqueduct, where no trespassers were allowed.




Above is a longitudinal section of a typical aqueduct entering the city of Rome. This valve arrangement was duplicated about every half mile in the line. It consisted of a tower where the water was forced to flow through two narrow openings as shown. At S are two weirs which were duplicated at every such tower, which created air compression pressure within the piping. These walls and apertures were used primarily to check the momentum of the water, while the fall was about six inches in a hundred feet. The arrows indicate the flow of the stream through these traps.




At the left are shown several sections of Roman pipe with brass valves. These valves are identical in design with those which we use today, the only difference between the two being the outside form. Most of the pipe used for interior purposes was made of lead in the form shown in the inset immediately above. Long sheets of the metal were cast out then placed around a wooden stick, and the ends soldered. At W is given a cross-section of a joint made between two metal pipes, showing how the hot solder was "wiped" around the outside. On cast metal pipe many names and inscriptions were placed. Usually the name of the house owner was found upon the pipe, since water privileges were granted only for a lifetime. Each consecutive heir had to obtain permission for himself to use the water and pipes upon the decease of the previous master. Joints and seams were made in different ways. Poured in structures, made with a soldering iron as at C, or "wiped" as at W. The latter method is still used.

October

25 Cents

# Science and Invention

## IN PICTURES

How to Use
GAS MASK
FOR DIVING
See Page 3

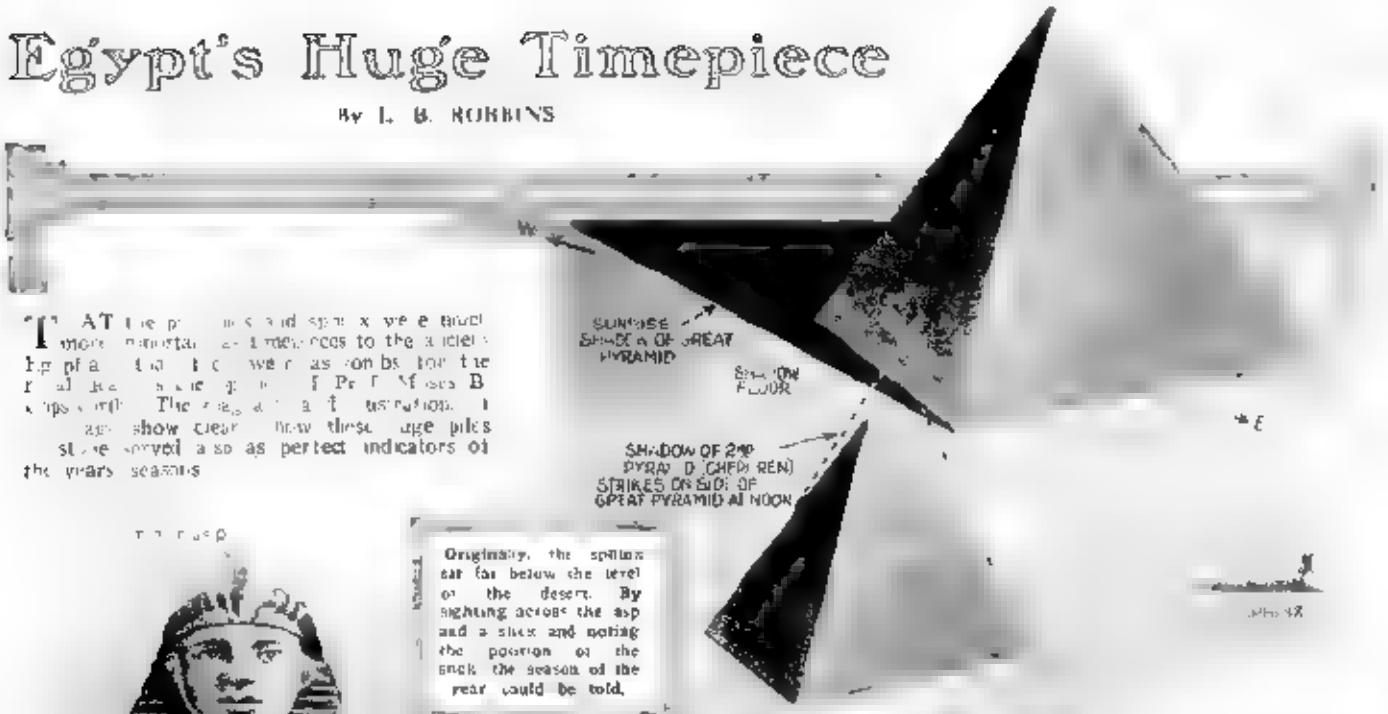
40 NON-TECHNICAL RADIO ARTICLES

EXPERIMENTER PUBLISHING COMPANY, NEW YORK PUBLISHERS OF
RADIO NEWS SCIENCE & INVENTION PRACTICAL ELECTRICS MOTOR

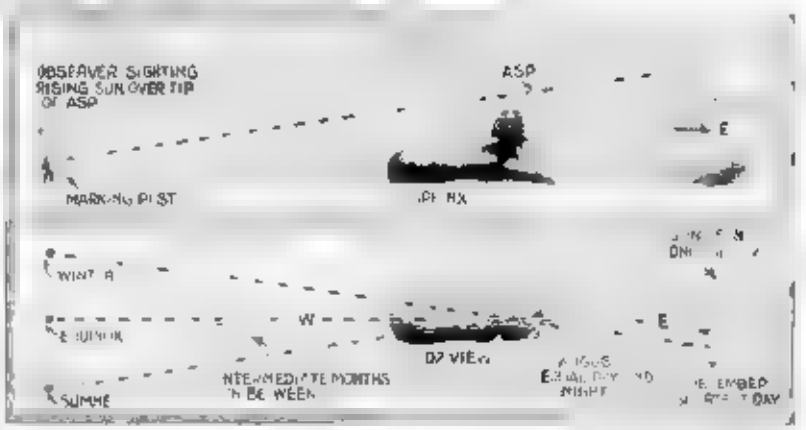
# Egypt's Huge Timepiece

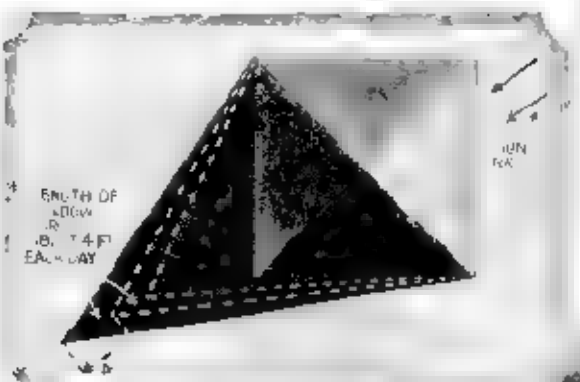
By L. B. ROBBINS

THAT the pyramids and sphinx were more important architectural features to the ancient Egyptians than mere tombs for the burial of their kings is the opinion of Prof. Moses B. Cotsworth. The evidence at first glance does not appear to show clearly how these huge piles could have served also as perfect indicators of the year's seasons.

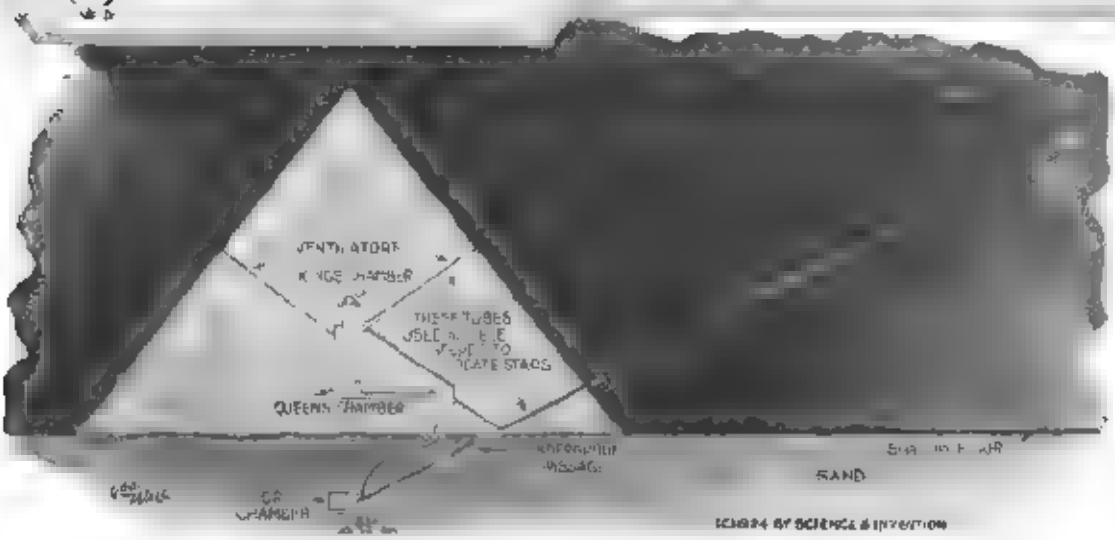



Originally the sphinx sat far below the level of the desert. By sighting across the asp and a stick and noting the position of the stick the season of the year could be told.




At the left is shown the method used in telling the exact day of the year with the aid of the great pyramid. With a difference of four feet a day in shadow length it was very easy, of course, at noon to tell the exact position of the sun which indicated the position of the earth in its orbit and so to tell the exact period of the year. This theory is strongly upheld by the fact that there is a great shadow floor or perfectly flat surface extending behind this pyramid for some distance. The use of the pyramids and the sphinx as time pieces was extremely important to the Egyptians because they had no other system which the tillers of the soil could use for noting the time of planting and harvesting. The sphinx was used to denote seasons by the system shown directly above. According to Prof. Cotsworth this system was not nearly as accurate as that with the great pyramid.




After examination of the various passage ways in and below the great pyramid the professor came to the conclusion also that at least one of them was used as a sort of telescope or other star finder with the high priests used for telling meridian time. Note that the long passage way in the illustration at the left goes directly to the north star. This system of taking the time when a given star passes the long side of a square is in all large observatories. This one case seems to be a particularly strong proof of the professor's theory.

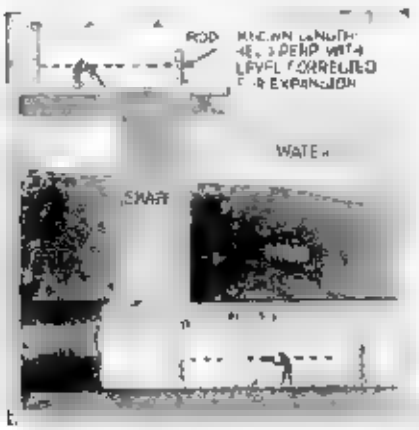
SCIENCE & INVENTION

# Hudson River Tunnels Meet

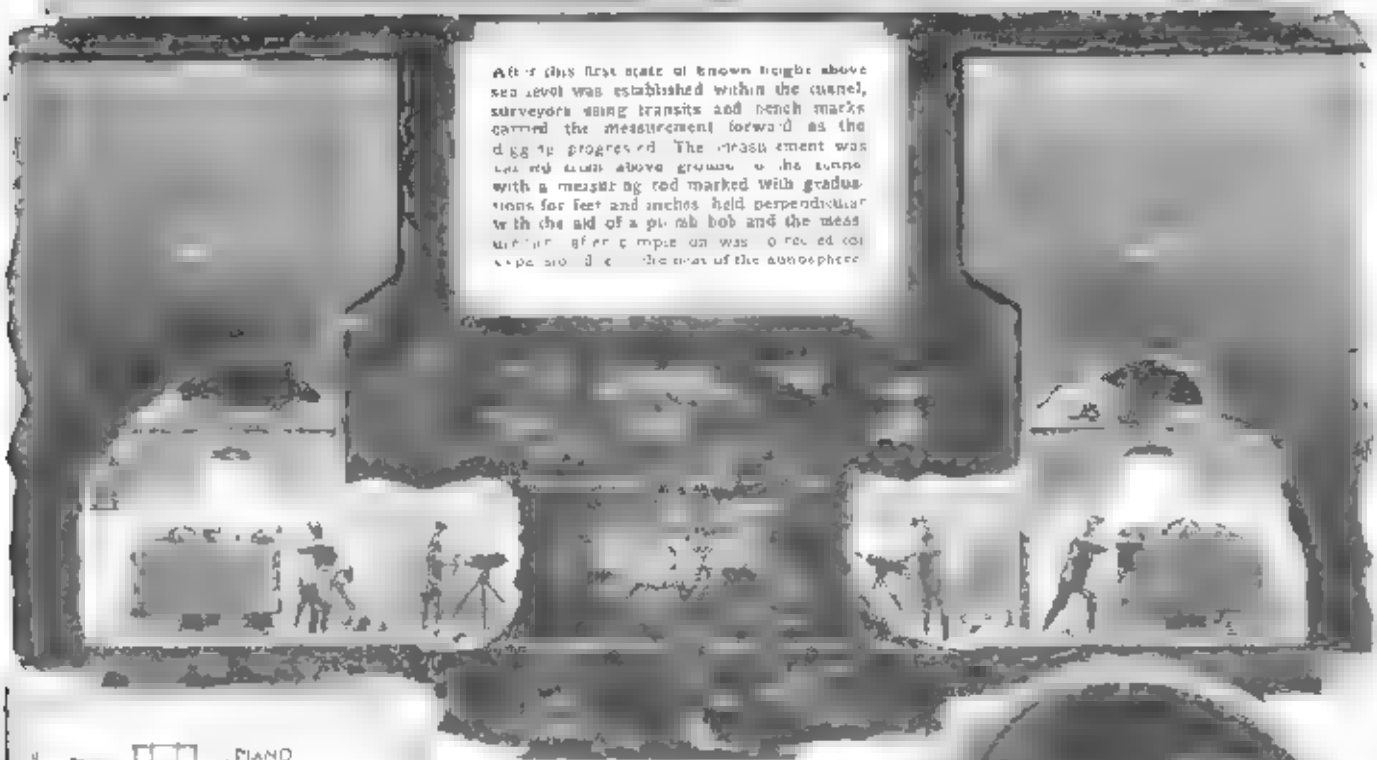
## Giant Surveying Job Comes to Successful Conclusion

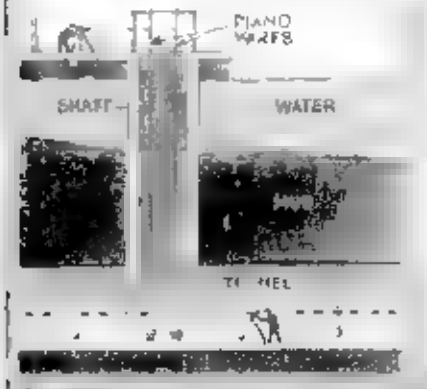
By W. B. ARVIN

THE two sections of the Hudson River Vehicular Tunnel, one being dug from New Jersey and the other from the New York side, meet in perfect union under the river, with a variation of only a few inches. This is indeed a feat of surveying since the base lines for both sides had to be taken from a long mile bearing, also the level or the vertical elevation of both shafts had to be maintained with the same accuracy as their lateral direction, else they would not meet. The sketch below shows the method used in running the level marks. A bench mark, or point of known height above mean sea level was set on both the New York and Jersey side. This mark was transferred to the tunnel as shown at the left

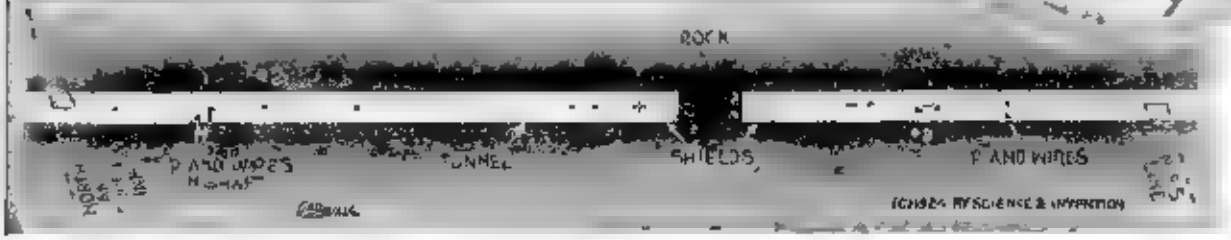


After this first mark of known height above sea level was established within the tunnel, surveyors using transits and bench marks carried the measurement forward as the digging progressed. The measurement was carried down above ground to the tunnel with a measuring rod marked with graduations for feet and inches held perpendicular with the aid of a plumb bob and the measurement after completion was corrected for expansion of the heat of the atmosphere



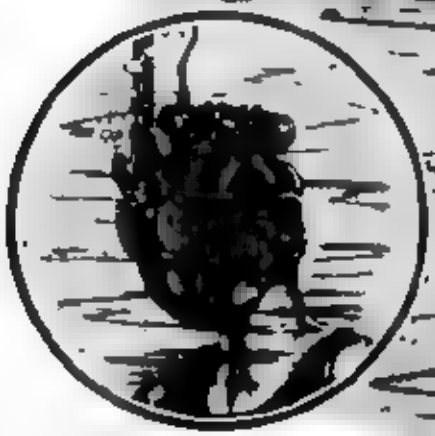



Above is shown the way the tunnels meet The forward line for one-half the tunnel was obtained by first taking a longitude observation, obtaining an absolute north and south line on both shores. Then two piano wires with weights attached were hung in this line down a shaft communicating with the tunnel proper. The surveyor below then set his transit in line with these two wires, so the same line, in effect, is used on both sides of the tunnel. At the right is shown the method used by surveyors in controlling the position of the head of the shield. Sighting from the plumb bob which denotes the line, the surveyor determines the direction of the shield, and with the level rod, its vertical location.



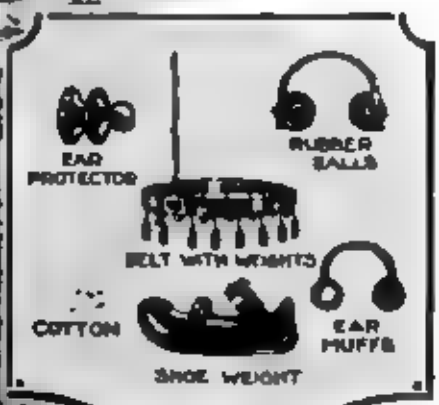
# Gas Mask Makes Diver's Helmet

By JOSEPH H. KRALS



Above is shown a close-up of the aquatic adaptation of the navy type gas mask. Air is seen escaping from the exhaust. The chemical tank may be filled with lead shot.

AT last a use has been found for discarded army and navy gas masks. Homer J. Smith suggests that they may be used as diver's helmets for the entertainment of swimmers and others who love aquatic sports. A rubber gas mask with ample suction cups to resist the water pressure is attached to the intake of the mask and is kept at the top of the water. But the arms and navy type mask may be used in a manner. In both cases an air supply hose is attached to the inlet intake which is removed from the metal tank. With the aid of a mask and air hose it is possible to make descents [illegible] of water. It will be necessary to carry weighted foot gear




Above is illustrated some of the weights sinkers and ear preservers

Actual photograph of a diver who was able to stay under water twenty minutes, using only an air hose

A diver equipped with gas mask who has an assistant's aid letting his air hose to a raft

For comparatively shallow water a flat iron held in the hand will often prove sufficient weight to carry the diver down. As with the weight belt a rope is attached to the iron so that when the diver comes to the surface the weights may be hauled up

November

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# Science and Invention

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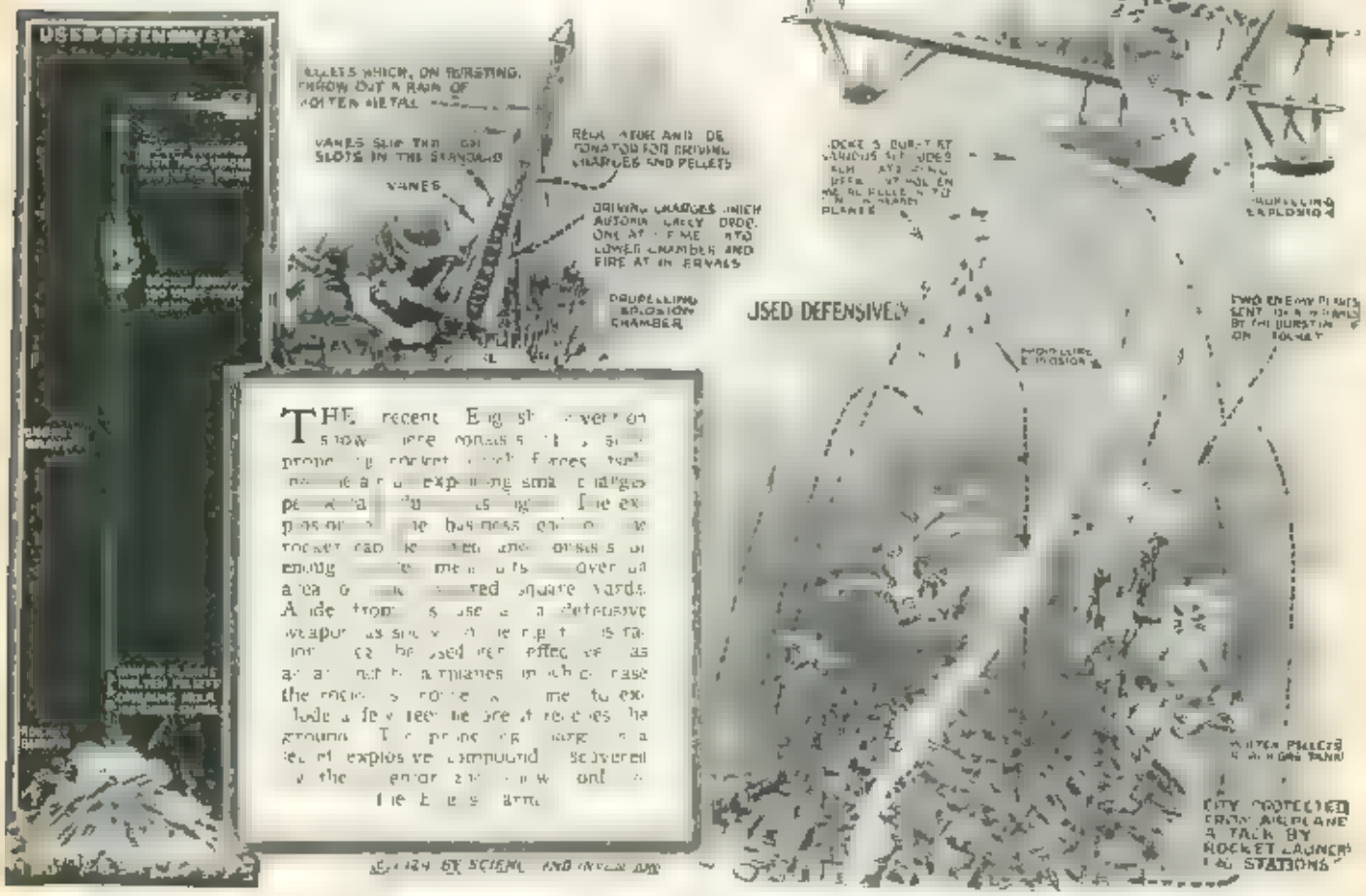
RADIO NEWS - SCIENCE & INVENTION - THE EXPERIMENTER - MOTOR CAMPER & TOURIST

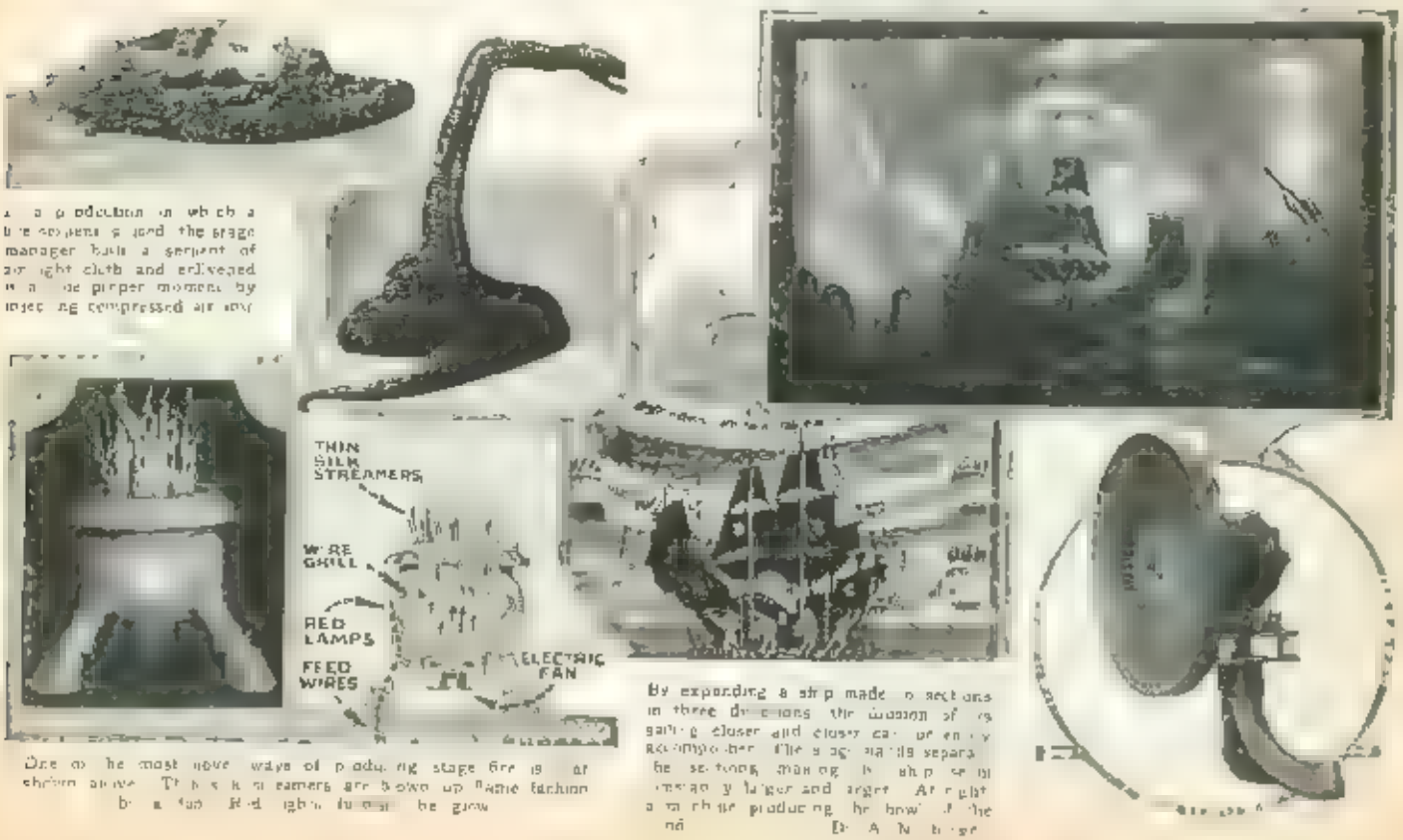
# Death-Dealing Rocket




THE recent English invention shown here consists of a steel projecting rocket which fires two-inch bursting and exploding small bullets per second up to a height of 3 miles. The explosive charge in the business end of the rocket can be set to burst at any height desired, thus covering a circular area of many hundred square yards. Aside from its use as a defensive weapon as shown above, the rocket is said to be used very effectively as an anti-aircraft weapon in which case the rocket is fired at the plane to explode a few feet below it, raining the ground with explosive compound scattered by the projectile. How one of the British army

SKETCH BY SCIENCE AND INVENTION

# Some Weird Stage Effects




...a production in which a live serpent is used the stage manager built a serpent of bright cloth and enlivened it at the proper moment by injecting compressed air and

One of the most novel ways of producing stage fire is as shown above. Thin silk streamers are blown up flame fashion by a fan. Red lights in front of the glow

By expanding a ship made in sections in three dimensions the illusion of sailing closer and closer can be easily accomplished. The stage hands separate the sections, making the ship seem increasingly larger and larger. At right a machine producing the bow of the ship

BY A. N. [illegible]

# Gold from Mercury

By DR. ALFRED GRADENWITZ

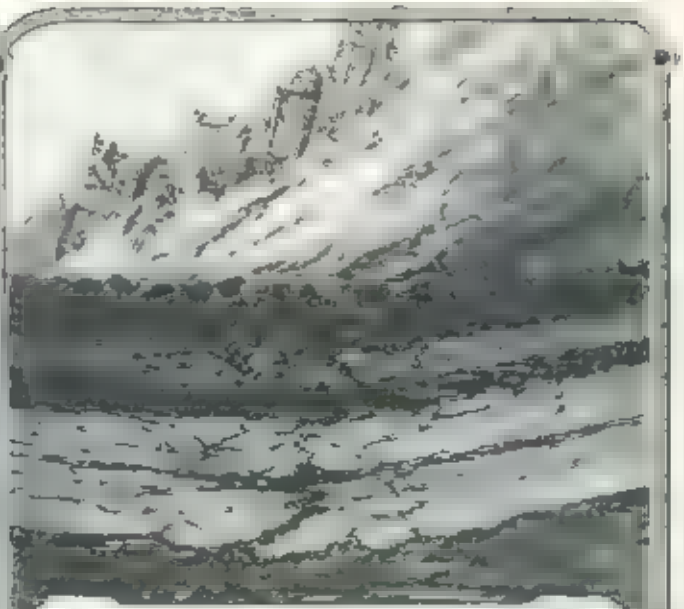
Special article from our German Correspondent

On the cover of this issue of SCIENCE AND INVENTION is given a picture of the modern alchemist changing mercury to gold. To the right and above is shown the huge mercury vapor lamp with pressure adjusting apparatus at the upper end, and the various electrical appliances used in the adjustment of this modern "Philosopher's Stone." The results of this experiment which has been so far reaching in the field of experimental science were due more to accident than to any well defined course of investigation as has been the case with many of the world's greatest discoveries. It is also important in that may give a clue to atomic disintegration

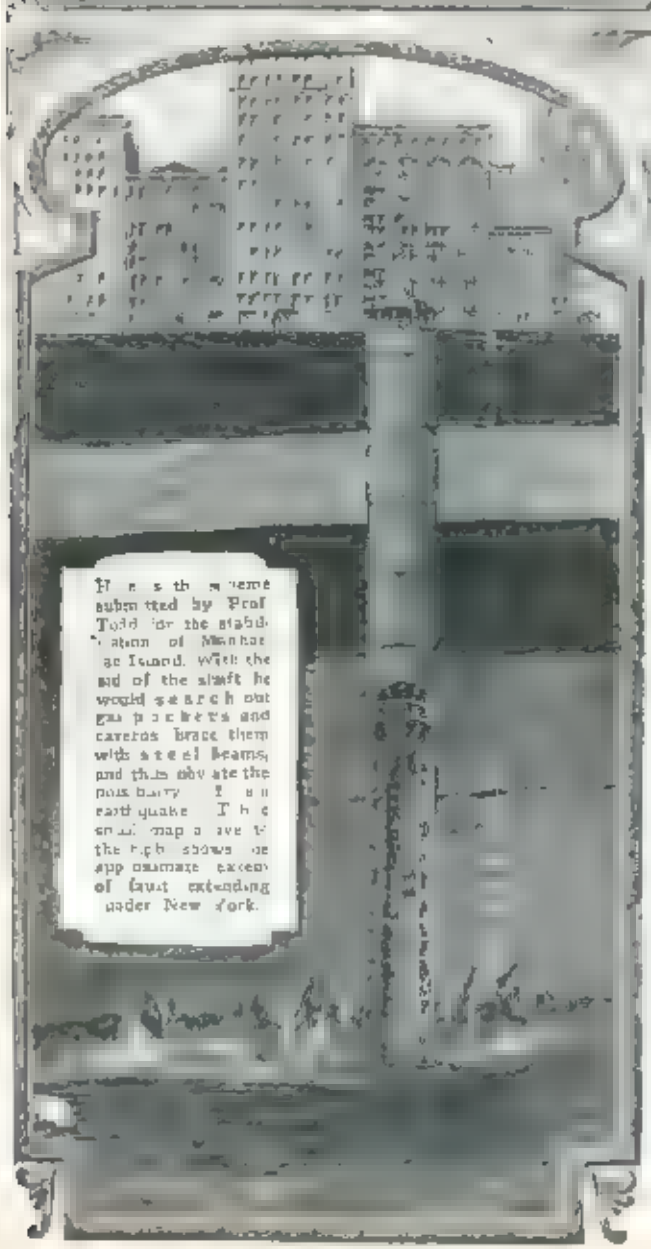
Arrangement above is shown graphically how the bombardment of the mercury atoms tears away one electron thus forming gold. N = Electrons. A = Mercury. B = Gold with one electron rearranged.

At last the ancient alchemist's dream has come true. A base metal has been transformed into gold. Prof. Miethe of Germany is working with a large mercury vapor lamp. Operating at a high voltage, recently discovered particles in a deposit on the walls of the tube which could not be identified through usual theory or surmise. Later they proved to be gold. At first it was thought that the gold was merely a reflecting deposit which originated as an impurity in the glass or in one of the electrodes within the lamp for the mercury. Later a mercury lamp was constructed from chemically pure components and the original procedure followed with the new lamp. The deposit was again noted and identified. Upon consideration of the chemical laws involved, the theory was found to check accurately with practice. It was noted that the mercury atom contained one more electron than the gold atom. It was immediately postulated that through some peculiarity of the [illegible] these electrons [illegible] could be added [illegible] thus reducing the substance to gold. However, this discovery of the transmutation of mercury into gold will have no effect on the world's gold mines, since the cost of producing the metal artificially [illegible] greater than that [illegible] the earth. The illustrations at the bottom of the page show graphically the extreme cost of [illegible] the [illegible] of electricity

Above is shown a cross-section of the earth's crust beneath New York as it is conceived by Prof. Todd. The arrows show the dissipation of the stresses of thirty million tons per square mile placed on [illegible] Island.



Our artist here gives his conception based on Prof. Todd's assertions as to the crushing and crumbling which would take place in the earth's strata below New York in the event of an earthquake. Note the sidewise rumbling.



Here the scheme submitted by Prof. Todd for the stabilization of Manhattan Island. With the aid of the shaft he would search out gas pockets and caverns brace them with steel beams, and thus obviate the possibility of an earthquake. The small map above the right shows the approximate extent of fault extending under New York.

# Will New York Be Destroyed by Earthquake?

In a recent statement given to the press Professor Davis Todd, astronomer and mathematician of Amherst College, says that [illegible] a fault running several miles from Trenton, N. J., across under Manhattan Island up through Connecticut and Massachusetts, and on account of possible gas pockets or caverns [illegible] would be possible for an earthquake of sufficient weight to cause a fault in the area [illegible] and [illegible] the rock [illegible] to slip and produce an earthquake. He bases the statement on the fact that during the past thirty years there were recorded over [illegible] of the type which might cause such a disaster. He suggests as a possible means of preventing the [illegible] a shaft or tube into the ground under the [illegible] in search of gas pockets or caverns, [illegible] were found with steel beams. However, Reverend Father [illegible] of Fordham University, [illegible] Professor Todd's statement, says that [illegible] earthquake [illegible] New York [illegible] says [illegible] earthquakes can only occur where there is a great deal of weakness and [illegible] there is not a chance under the eastern part of the United States [illegible] strong to cause any [illegible] would be to have [illegible] the skyscrapers," says Rev. Tondorf. "And even if it were possible to [illegible] the [illegible] stress [illegible] to a [illegible] scarcely [illegible] under the sea and there is absolutely no [illegible] or [illegible] that would [illegible] the [illegible] underlying New York.

# Science Pictorial

The Baltimore and Ohio Railroad has recently purchased several electric locomotives which run on rubber tires to be used in switching around large terminals. The locomotive runs directly on the pavement, obviating a great deal of work for the engineer. The current is furnished by a generator coupled to a gasoline engine contained in the locomotive. The engine can turn in its own length. —P and A Photos

Imagine the surprise of Colonel S. M. Swinnerton of Los Angeles when he started to make a lemonade out of a lemon and inside of it found a perfect miniature of a lemon tree. The plant was evidently growing and in good condition. The outside of the lemon was perfectly regular there being no markings of any kind which might have given the secret away.

The latest contraption in the Olympic games. Above is a photograph of two of the machines used in the event. The riders sit on top of the pipes on the inside of the large wheel which is the chief component of the vehicle. —Fotogram, New York

Twenty years ago F. A. Hummel of St. Paul, Minn., invented a machine for transmitting pictures over wires. It was not tested until recently when it was found to be a success. The machine employs a vibrating needle which passes over the surface of a traced picture so that it marks the lines and blank spaces. The inventor is a watchmaker. —Fotogram, New York

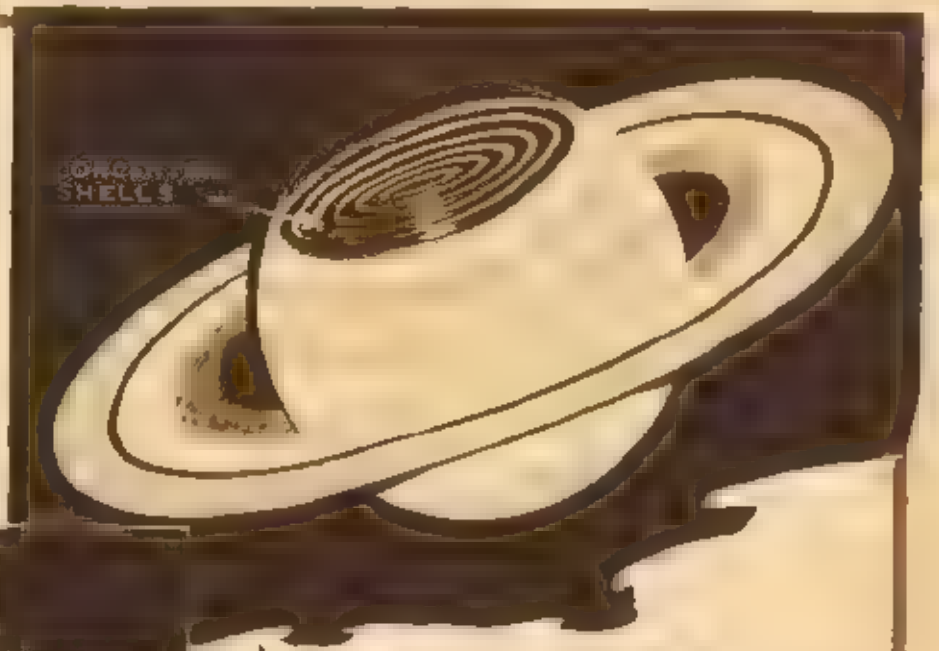
Mr. A. Timbers claims that he was the originator of the death ray idea now claimed by H. Grindell Matthews. Above he is shown trapping a mouse with his ray.

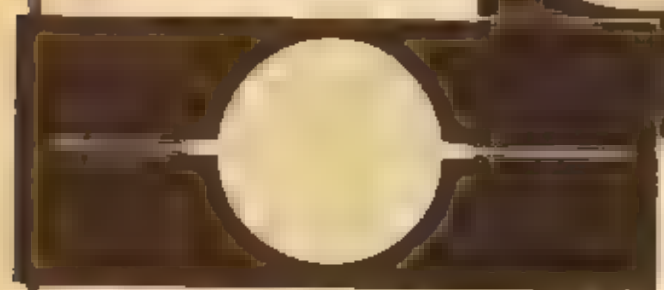
What is possibly the largest tractor ever built is the one shown below on the left which was built for a Pacific Coast logging company. It is run by an internal combustion engine as is the ordinary tractor. It weighs ten tons and has a wheel base of eighteen feet. The wheels are 8 ft. in diameter.

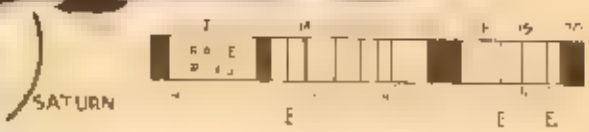
Due to narrow streets the trucks shown are able to automatically solve many traffic problems.

# The Problem of Saturn's Rings

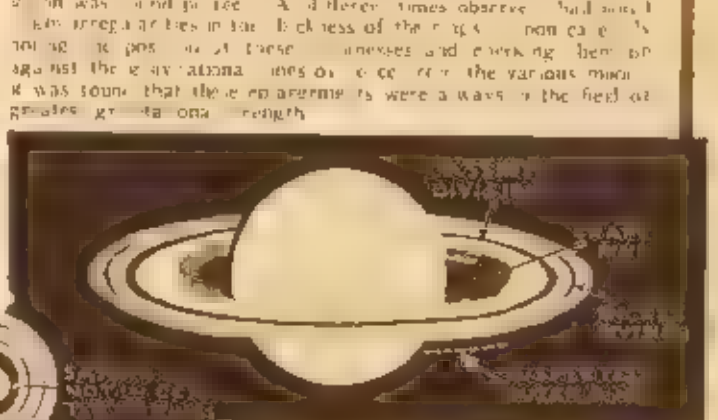
HOW scientists prove that Saturn's rings are composed of [illegible] small particles, and that the planet was originally composed of the same mass in a state of a gaseous [illegible] since the inner ones revolving more swiftly than the outer ones, makes an interesting story. Galileo was the first to notice a peculiarity concerning the planet. He thought, however that what later proved to be the rings, were merely two huge satellites. It was not until very recently that the facts concerning the planet, its composition as well as the composition of the rings, and various peculiarities which make themselves manifest from time to time, have been thoroughly understood. Scientists are working constantly on the many problems





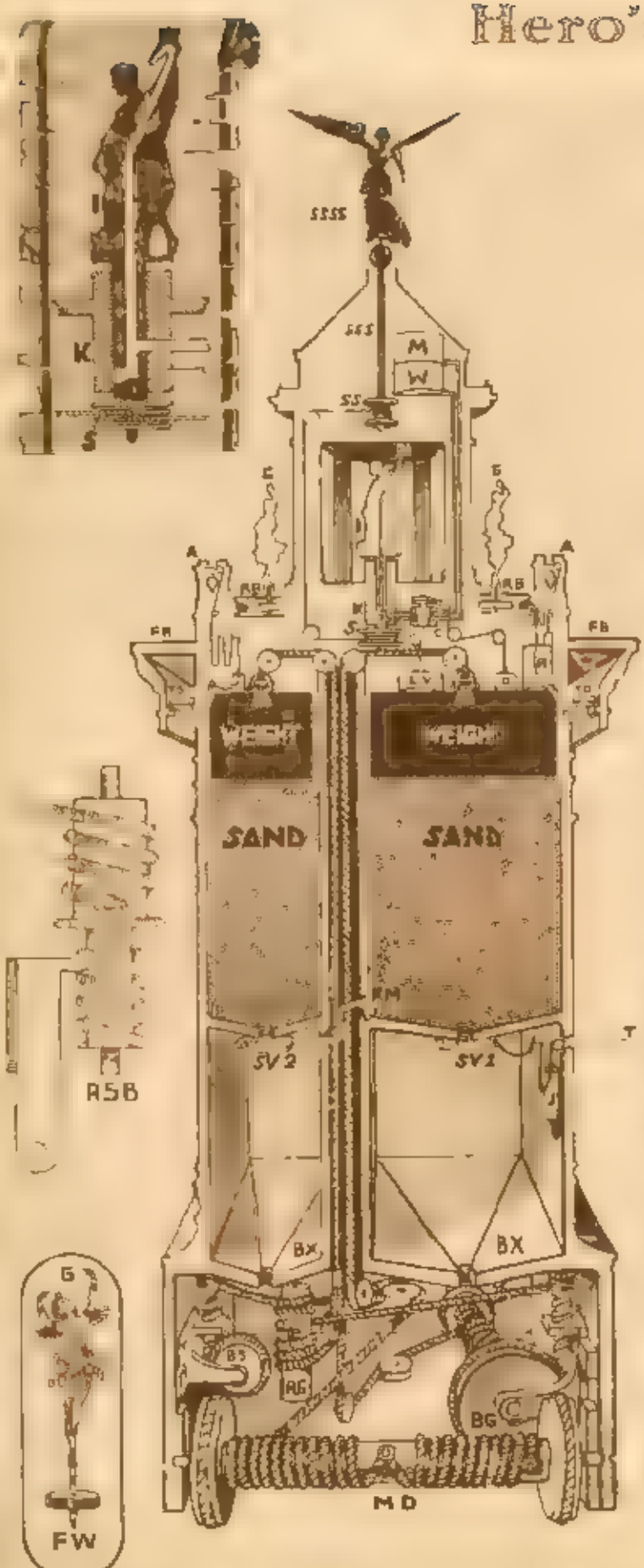

[illegible] most startling theories concerning the planet were made with a spectroscope. Watching the shadow cast by the rings, it was definitely proven that the rings consisted of small particles and that the inside of the rings revolved more swiftly than the outside, one revolving in pure matter-ellipses. Professor Lowell at the Flagstaff Observatory Arizona, proved that the attractive effects of Saturn's moons would leave the rings with various gaps in them. This computation was made itself in connection with the well known one. This was the astronomical law that where two bodies rotate at periods which are multiples of each other, one of the two bodies must change its orbit. The small sketch shown just under the cross-section illustration gives the result of Prof. Lowell's computations. The dark spaces show where gaps had to occur according to mathematics. The gaps shown at 17 is Cassini's division, and that at 20 Encke's division. However, when these calculations were checked up against observations, it was found that the divisions were shifted slightly away from their actual position as observed. This led to the postulation of the theory that Saturn was not a solid planet as previously supposed, but a system of concentric shells as shown in the accompanying illustration above. The inner shells revolving more swiftly than the outer ones. When the mathematics were rechecked with theory and hence between observation and calculation was found to be. At different times observers had noted irregularities in the thickness of the rings. In order to explain these unevenesses and reconcile them up against the gravitational laws of celestial mechanics, it was found that there arrangements were always in the field of [illegible] gravitational strength.



By observing the passage of a star behind Saturn's rings and noting its comparative brightness as it shifted from one division to the next, it was proven conclusively that Cassini's division was an actual division, and that the Crape ring was thinner than its others. Also, since the star was not observed to flicker it followed that the particles in the ring had to be [illegible] three hundred feet or less in diameter, as not [illegible]

As to the origin of the second rings and observations scientists believe that the rings were formed by the shattering of some other body passing in close proximity to the planet. It was calculated that no solid body could exist near Saturn if its distance were less than 2.38 times the radius of the latter. Since such is the case, and since it was definitely proven that solid matter could not exist so close to the planet, it was postulated that some solid body was shattered into small bits thus forming the rings. A number of observers have recently brought forth claims that another outer ring exists at the edge of the present one. Such a ring is required by a mathematical theory, and one or two famous observers have brought forth claims of having seen it. However as yet there is [illegible] observation proof to make its existence accepted.

# Hero's Automotor




PTOLEMY PHILADELPHUS Prince o Egypt graced the try-out of one of Hero's a tom ons. He saw the sleeper three and the machine start off throwing flower his feet—wh le the peace emblem fel out, toss wing and flew away He noted the six dancing g rls spun on their toes as they circled the temp [illegible] another direction he [illegible] as he poured upon a [illegible] and wine and at the same time the two altars were be ching forth perfumed smoke

After the automaton had gone thirty feet it stopped, then it reversed and came back the entire distance and saluted the Pharoah with a shower of lotus blossoms Then it seemed to rise when it made a circle and saluted with m [illegible] birds, then it did a circle [illegible] ated by releasing wine most [illegible] at which Bacchus emitted a prolonged and shrill whistling wai

In action the thread "ST" releases the weight [illegible] which cuts thread "T" releasing a weight "J" whose fa l [illegible] de valve "V" [illegible] to run out—which allows the weight in the larges compartment to fall slow y, its power is communicated by rope over two pulleys, thence downward, connecting with drum "MD" that actuates the drive wheels After part of the [illegible] MD [illegible] the [illegible] The we h [illegible] rotates the [illegible] BE KD [illegible] wheels "FW" spin the girls [illegible] the temple We g [illegible] D, in so doing opens compound valve [illegible]

ank M" "W" which contain mo ke, wine and [illegible] back [illegible] off [illegible] weight "L" turns spool S the [illegible] K and [illegible] the Bacchus -the three which are one piece of metal The cord from "LV" after leaving "S, the spool goes bobbin "SS." there [illegible] the Victory statue, "SSSS" through shaft "SSS." When the large weight nears the end of its trip it unhooks from the drum "MD" and trips the cam "KM" which opens slide valve "SV 2," releasing sand and making the small weight through its rope connection [illegible]

(Continued on page [illegible])

# Dating 200 B. C.

By Charles B. Burnell

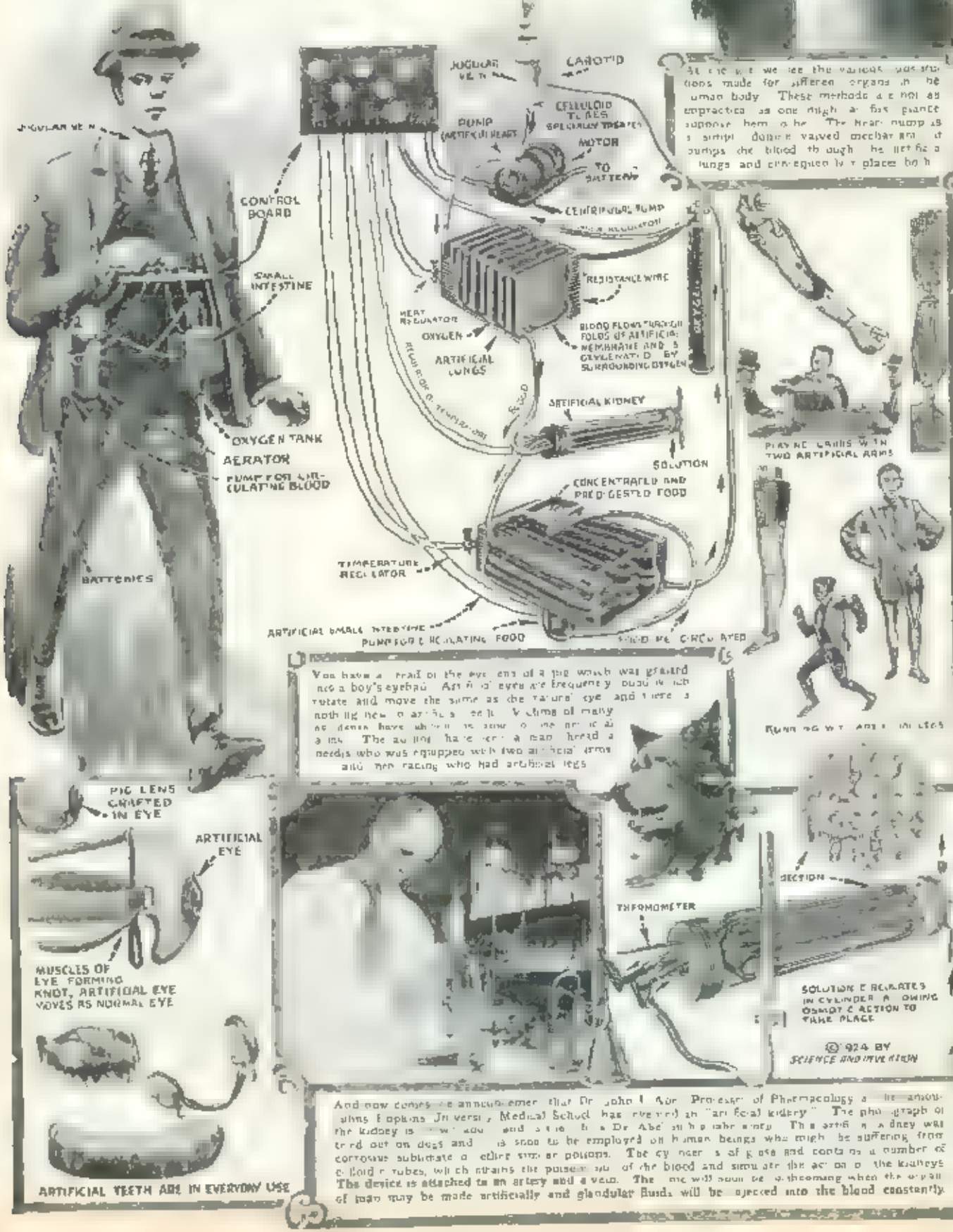
THE automaton made famous by Hero's writing was one of the mechanical marvels of ancient times. Upon straight rays and staff that bed circle opened up flowers released a dove which encircled by dancing girls, carried a figure of Bacchus which poured with a fairly quick and wide arc was surmounted by Winged Victory which revolved on an axis. Upon one occasion I entertained one of the great Pharaohs or kings of Egypt shortly after that famous figure acquired also a royal road to mathematics, and was told it did not exist.

# The Artificial Man

## Removing the Fangs of Death by Substituting Organs of the Body Which Have Succumbed to the Effects of Time and the Ravages of Disease

By JOSEPH H. KRAUS and H. WINFIELD SECOR

Miss Blanche Brier before and after surgeons reshaped her nose

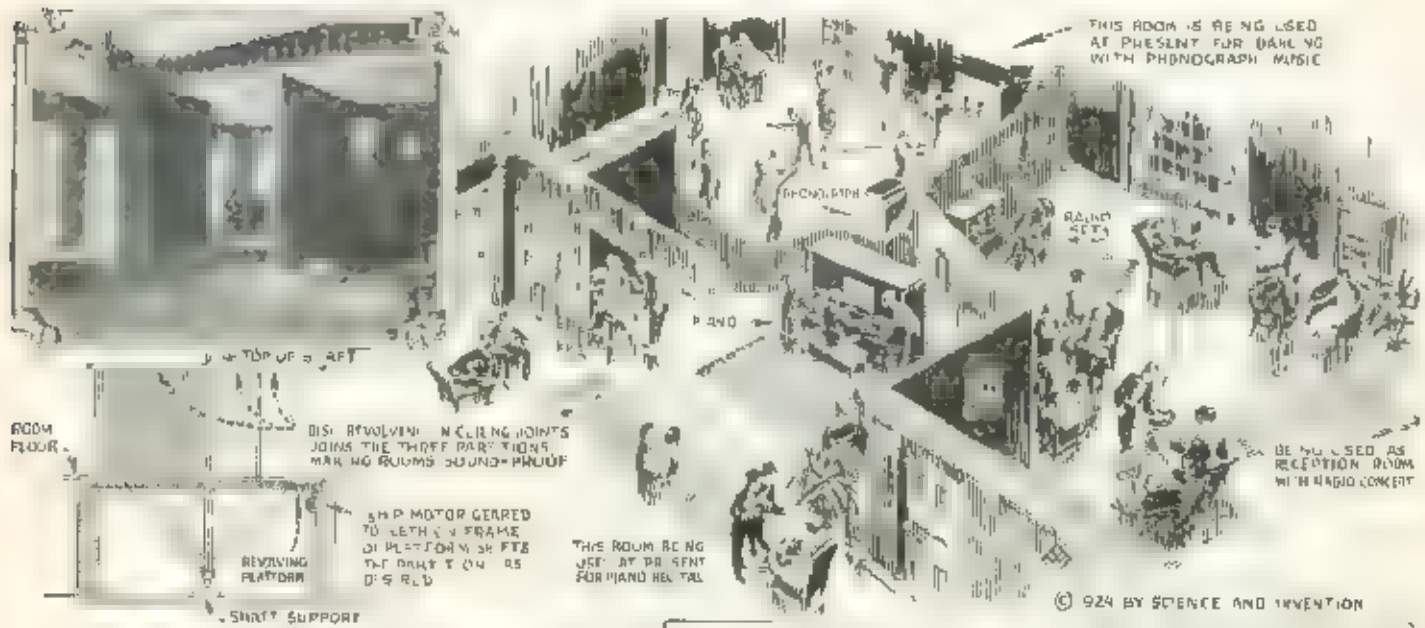


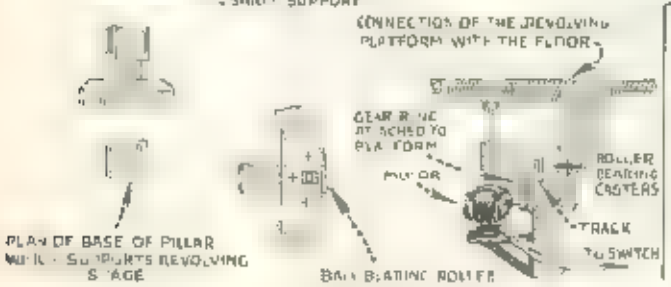

At this point we see the various modifications made for different organs in the human body. These methods are not as impractical as one might at first suppose them to be. The heart pump is a simple double valved mechanism that pumps the blood through the lungs and circulates it to places both

You have a braid of the eyelashes of a pig which was grafted into a boy's eyebrow. Artificial eyes are frequently used which rotate and move the same as the natural eye and there is nothing new to artificial teeth. Victims of many accidents have wooden legs and arms. The author has seen a man heard a needle who was equipped with two artificial arms and two racing who had artificial legs

And now comes the announcement that Dr. John J. Abel, Professor of Pharmacology at the famous Johns Hopkins University Medical School, has invented an "artificial kidney." The photograph of the kidney is shown above and at the left is Dr. Abel at the laboratory. This artificial kidney was tried out on dogs and is soon to be employed on human beings who might be suffering from corrosive sublimate or other similar poisons. The cylinders of glass and contains a number of colloidal tubes, which strains the poisonous out of the blood and simulates the action of the kidneys. The device is attached to an artery and a vein. The time will soon be forthcoming when the organs of man may be made artificially and glandular fluids will be injected into the blood constantly

# Making One Room Into Three

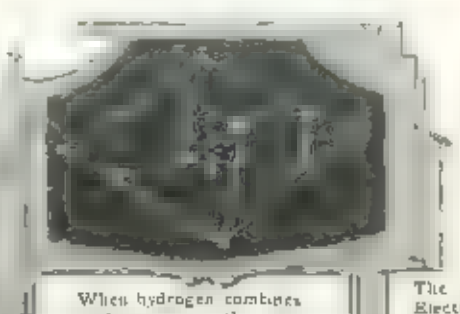



GERMAN architects have recently evolved the idea of operating rooms on the Broadway style by means of large apartments. The system is based on sliding partitions and movable floors, by means of which the interior of the apartment can be changed from one room to three rooms in a few minutes. The floors are so arranged that they can be shifted by the use of small electric motors. The walls may be so arranged that the floor of the apartment is divided into three parts, each of which may be used as a separate room. For example, a piano may be placed in the middle room and a radio set in the room to the left. The partitions are provided with sound-proof doors, so that the persons in the three rooms will not disturb each other. The mechanism is simple

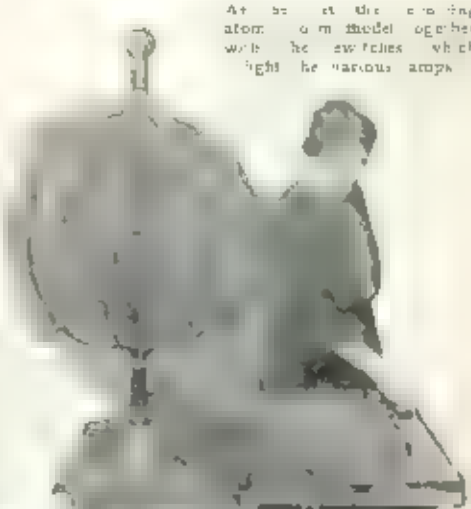
# Model Shows Atomic Forms

Above is shown a model of the oxygen atom with two of its corners cut away. In the center are the nucleus around which revolve the eight electrons of the atom.

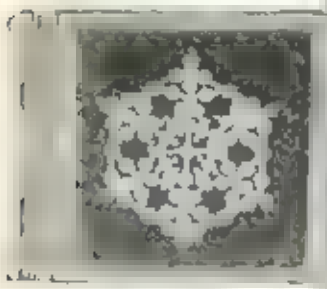


When hydrogen combines with oxygen the two hydrogen nuclei are assumed to place themselves in the unoccupied corners of the oxygen atomic structure as shown above.

The General Electric Company have in the laboratories constructed an atomic models of circles and ogbs, shown at the right



At bottom of this page atom models together with the particles which might be various atoms



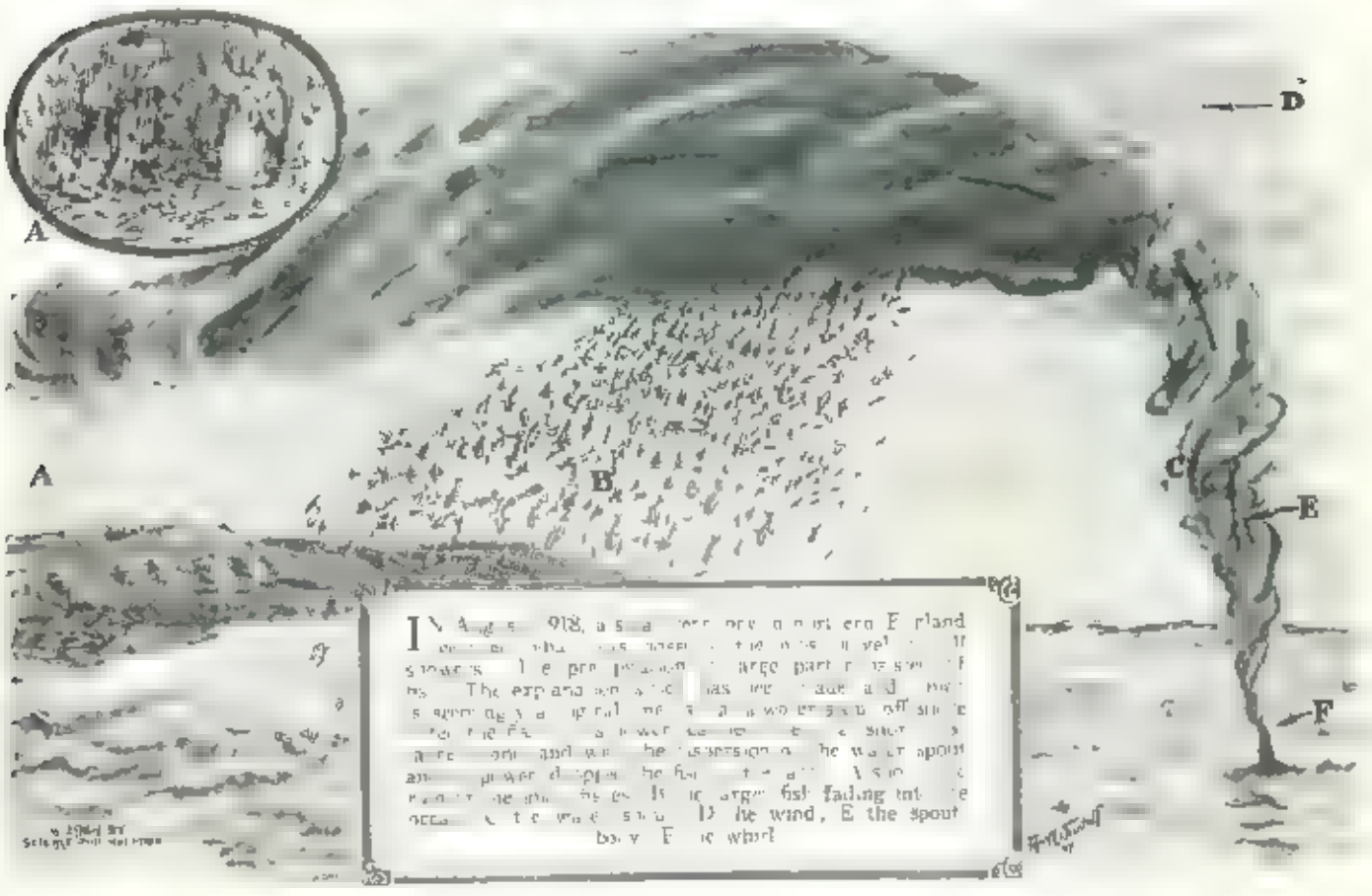
Above is shown highly magnified an ordinary table salt crystal, illustrating how the crystalline form composes themselves symmetrically about a center removing a very much distribution of material.

Two hydrogen atoms unite to form a single molecule. The complete arrangement follows somewhat the shape as shown above

The hydrogen atom the simplest known, consists of one electron revolving around its nucleus, as illustrated above

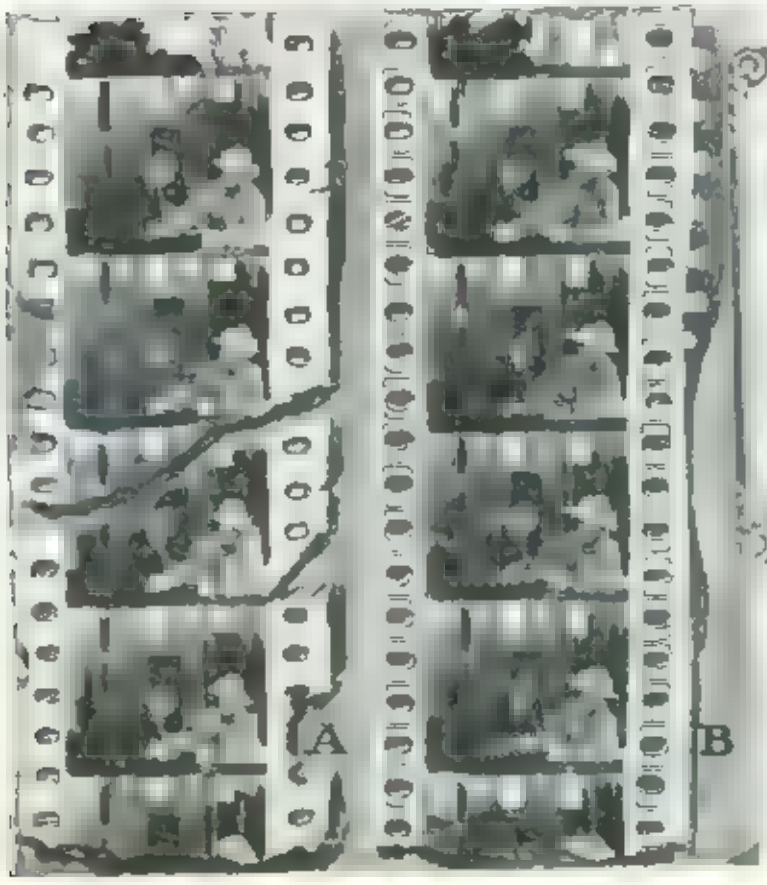
The point of a pin allows a billion billion molecules to rest comfortably upon its point

# A Rain of Fish




IN A[illegible] 918, a s[illegible] were prevailing in the northern England [illegible] which was accompanied by a heavy fall of fish. [illegible] The explanation [illegible] was made that [illegible] a waterspout off the [illegible] the fish [illegible] and were [illegible] the suction of the water spout [illegible] power dropped the fish [illegible] A, the large fish falling into the [illegible] B the wind, E the spout [illegible] F the wharf

# Prolonging the Life of Films




Below is shown a view of the film-facing machine which attaches the small copper ribbons to the sides of the film. The work is quickly and accurately done

ONE of the most costly divisions of moving picture production and projection is the constant wear at the sprocket holes in the side of the film. A Philadelphia inventor has recently brought out a novel means for prolonging the life of the film by binding small strips of thin copper along the edge of the film, thus giving a [illegible] and preventing excessive wear. Both sprocket holes and both edges of the film are protected by the copper, the opposite sides being clamped through, so that the strongest possible construction results. It is claimed that this method of protecting the film will save many thousands of dollars in extra positives, which have been required in the past

# Readers Forum

## WHAT HE LIKES

I am an old reader of your magazine my attention having been attracted, a few months ago, to one of your popular articles on Astronomy in which subject I am much interested. I have perused your magazine for a few months, and am glad to say that I believe your new issues are a great improvement on what was already a vastly interesting publication.

Although your magazine is manifestly intended to be popular, and is not written for the [illegible] scientist nor the professional engineer yet, [illegible] early. (This does not apply to your fiction.)

[illegible] divisions of subjects are admirable. I feel sure that your PRIZE CONTESTS will bring to public notice very many interesting and useful things, which would otherwise have remained dormant. The Editor of THE ORACLE has a hard row to hoe as a matter of course, but he is making his department interesting now, and I have a feeling that he will make it increasingly so.

Allan V. [illegible]

## A BOUQUET

Perhaps my opinion will not be of a great value. Nevertheless I dare to say I know how to make a distinction between what is worth [illegible] Another subject in the art of writing of expressing my ideas before a public so well cultivated as the American [illegible]

casting a glance upon the titles of the newspapers [illegible] best was the name [illegible] dea, great as when I opened it read some of the articles and saw some of the energy has contained [illegible] articles which was published before under another name, but today, this Golden Rule and cover is di[illegible]

Today when we are in the century of Science and in nation nobody who has a reasonable of [illegible] service ask [illegible] ed." And they are right. The real wise man, who pays attention to the ultimate truth of things goes into the study deeply. He first [illegible] the acquaintance with the object. But he [illegible] it has been produced and what it can do [illegible] of everyone the easy acquirement of much scientific knowledge, that in other ways it would be very [illegible]

Who is eager to enlarge and keep [illegible] of his knowledge must go and drink in [illegible] science to acquire what may be [illegible]

Cincinnati

*(Mr. Gutierrez, the writer of the letter [illegible])*

## SUGGESTIONS ARE IN ORDER

Editor *Science and Invention*

There are some things I approved of in Science and Invention and some that I do not.

Your idea of putting the magazine in [illegible] not for the Constructor and How To Ma[illegible] [illegible] old commonplace of discovery that has led up to [illegible] step by step, as [illegible] the comic sections of newspapers, the creation of the Universe by the nebular theory. The coming of life (with [illegible]

## SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of [illegible] The [illegible] Please write your letters [illegible] words and address [illegible] Readers' Forum, Science and Invention, 98 Park Place, New York City.

[illegible]

Also why not have a page each month with pictures of some room in a museum, for instance "The Hall of the Age of Man" in the American Museum of Natural History or the First Egyptian room in the Metropolitan Museum of Art?

And again those covers! When I look at your [illegible] August issues it looks as the covers at least are not to keeping with the improved [illegible]

Why not have some covers such as never appeared on the magazine before [illegible] lightning, queer animals, plants, fishes, [illegible] es, mighty telescopes, prehistoric animals [illegible] scenes in the [illegible] I believe if [illegible] the things I have mentioned up in a vote, you would find many that think be same as I [illegible]

*[illegible] to argument other readers.*

## The Experimenter

[illegible] one [illegible] if you [illegible] of the [illegible] [illegible] old [illegible] [illegible] DEPARTMENT [illegible] [illegible] has been changed into an entirely new kind of magazine entitled

## The Experimenter

which [illegible] a beautifully [illegible] circulation, you will find [illegible] new departments:

Experimenting Radio
Experiments Chemistry
Experiments [illegible]

There [illegible] reasonably [illegible] experiments [illegible] the [illegible] [illegible] the most useful [illegible] the [illegible] [illegible]

One [illegible] special [illegible] now added [illegible] the magazine [illegible] [illegible] [illegible] the magazine [illegible]

Be sure to reserve a copy from your newsdealer [illegible] issue is sold out. THE EXPERIMENTER PUBLISHING CO., [illegible] 304 [illegible]

Hugo Gernsback
Editor

## EVOLUTION

Editor *Science and Inven[illegible]*

[illegible] trouble is some silly little thing, that you wonder how in the world you could have been stupid enough to [illegible] I have [illegible] we go back over them, if we really stop to [illegible] entitled "Evolution" in the January Science and Invention and have [illegible] with wonder and astonishment at what you have to say [illegible] [illegible] is simple.

So it is with every branch of learning. Truth [illegible] [illegible] and not in the far off distance. Evolution is a theory, designed to explain how [illegible] [illegible] profane, but there is not one thing that has absolutely been proven [illegible] and even prob[illegible]

[illegible] of the evolution of a plant into an animal, of the evolution of an irrational animal into a rational. I will admit that it is not a contradiction of terms to say that it is possible that a plant should evolve into an animal, but it is a contradiction in terms to say that the irrational could, of itself, evolve into the rational. The rational part of [illegible] something that is wholly and entirely beyond the scope of matter. No reasonable man would say that in matter there is the possibility of the conception of an abstract idea, and yet, man is able to conceive the abstract. How then could matter evolve into something that wholly transcends it? Reason is the power to conceive the abstract. Power to conceive the abstract [illegible] [illegible] this something which is capable of possessing this power found in physical matter? Certainly it is not. [illegible] manifest this [illegible] [illegible] man is [illegible] of reasonable?

No man of sound reason will deny that there [illegible] How these [illegible] explanation is ma[illegible] [illegible] [illegible] [

December

25 Cents

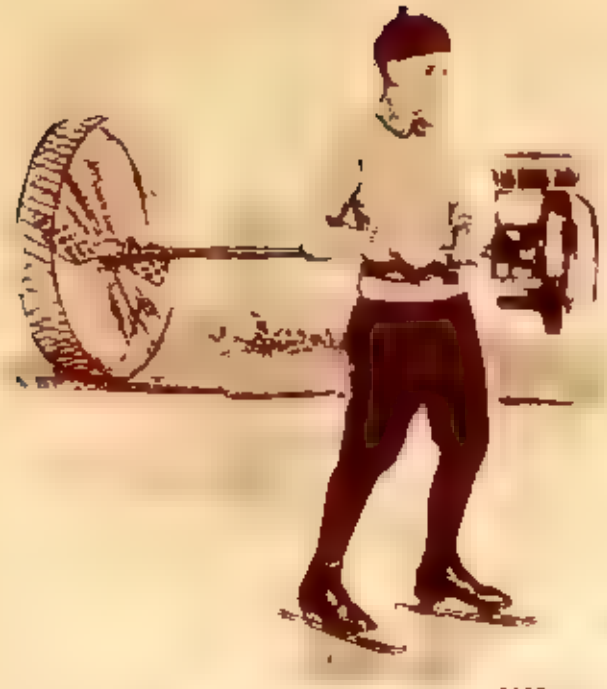
# Science and Invention

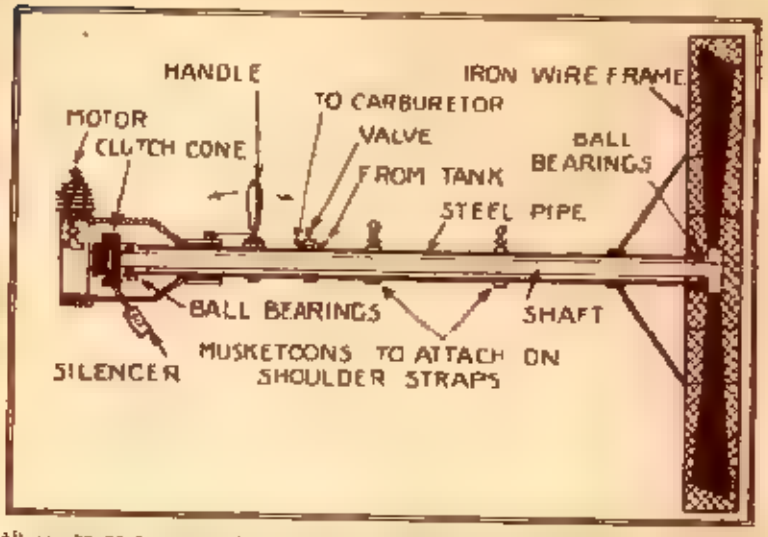
IN PICTURES

EXPERIMENTER PUBLISHING COMPANY, NEW YORK, PUBLISHERS OF
RADIO NEWS - SCIENCE & INVENTION - THE EXPERIMENTER - MOTOR CAMPER & TOURIST

# The Motopeller

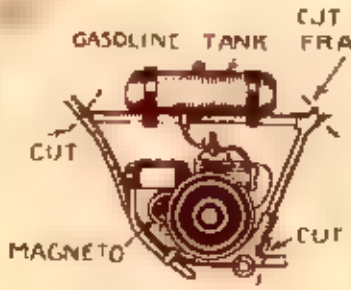
By P. C. J. PETEGEM OF ROTTERDAM HOLLAND

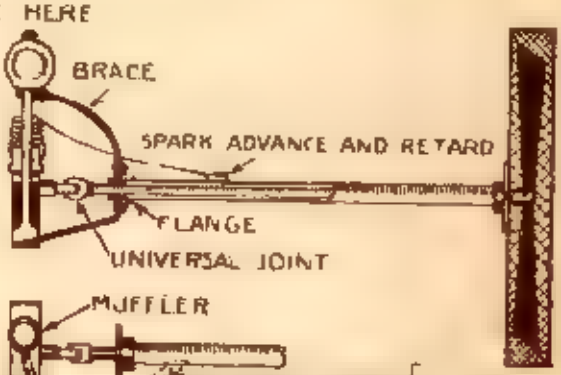


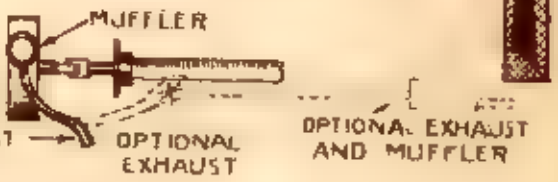


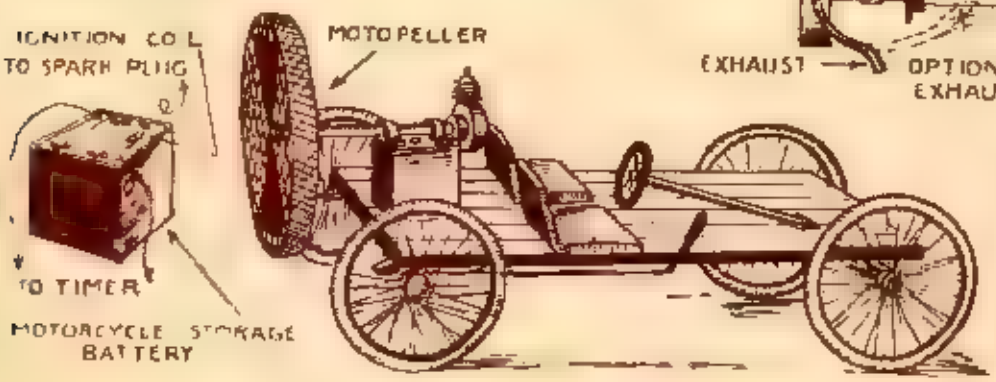

All of the necessary construction details are given above and on the following page. Dimensions may be changed to suit

The above photograph shows a Motopeller that has actually been built and which gives excellent results. A three horsepower motorcycle engine is used in connection with a 1½ horsepower gasoline engine

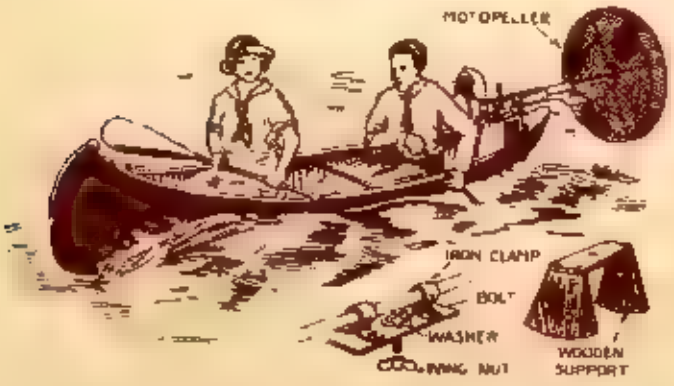


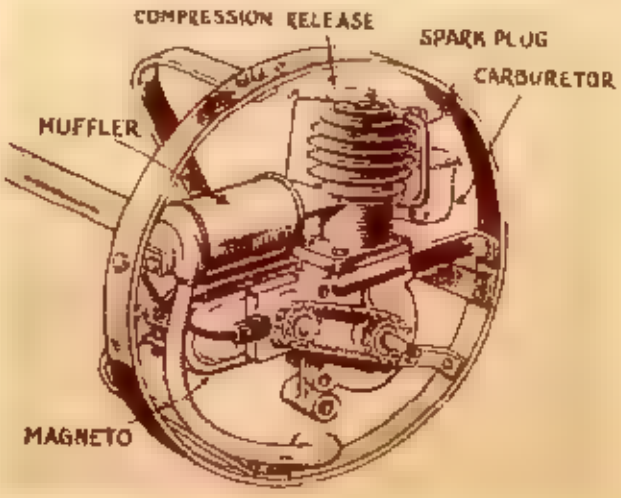



Directly above is shown how a standard light weight motorcycle may be used in constructing a Motopeller. The frame is cut off as shown and used to support the motor as well as the drive shaft. Below the motor are shown optional methods of placing the exhaust allowing it to run through a hollow propeller shaft alongside the shaft housing or to the side of the boat. The latter is the simplest method although it throws the gases toward the operator when skating




The Motopeller may be used for skating, or it may be placed on a small wagon or in a canoe. All these methods are illustrated above. At the right is shown a close-up of a completed Motopeller



# The Future

SOME of the wonders which we may expect from science are pictured on this page. Most of these are the ideas of J. B. S. Haldane of the University of Cambridge. One of the first advances which we may expect is the perfection of cold light. When that time comes we may expect cities to be so lighted that ordinary lamps for illumination will be prohibited by statute.

Radio vision is almost with us now. The work along this line is fairly well known to readers of SCIENCE AND INVENTION. However the future will find it developed to perfection.

There is much talk at the present concerning the effect of radio on weather conditions. Our scientists will no doubt control perfectly the atmospheric conditions with the aid of a few simple radio sets delivering power into the air.

And as for power in the future it will all be developed through the agency of an atomic motor. A very small amount of space will be required for the greatest of powers—and it will be under perfect control.

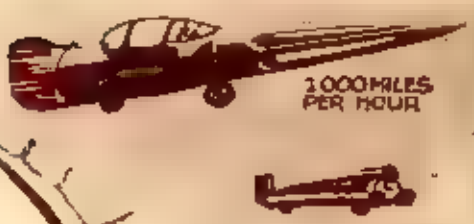
Our suns will see wonderful aerial developments.

Another source of power will be found in wind mills condensing hydrogen to a liquid form and storing it in vats.

Our food will be a chemical substance in the form of pellets. German professors have already ascertained that acid sodium phosphate increases the endurance of man's muscular power some seventeen per cent.

Glass will find greater and greater use as architecture and buildings will become constantly larger. Interplanetary communication will be a constant accomplishment performed possibly by radio and of huge illuminated areas of the oceans or large deserts.

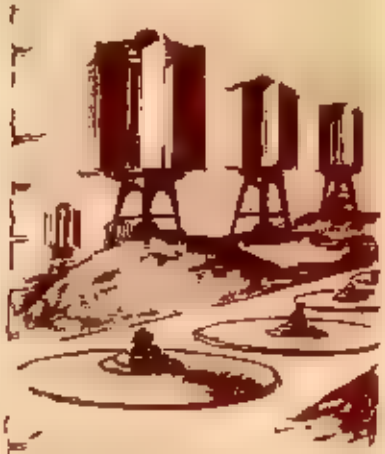
COLD LIGHT 95% EFFICIENT



1000 MILES PER HOUR



AERIAL FREIGHTER

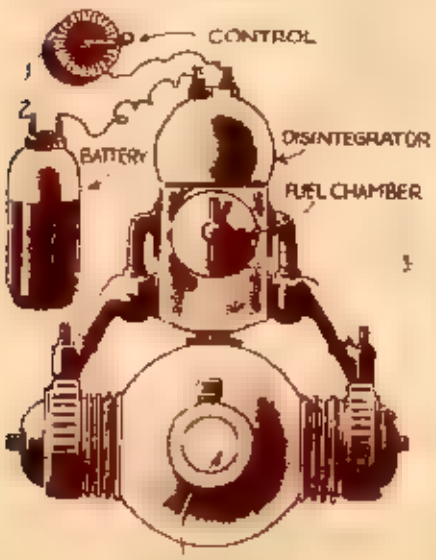


WINDMILLS AND LIQUID HYDROGEN STORAGE VATS

RADIO VISION

ACID SODIUM PHOSPHATE AS A BEVERAGE
FOODSTUFFS MADE OF COAL AND ATMOSPHERIC NITROGEN

RADIO POWER STATION DISPERSING RAIN CLOUDS

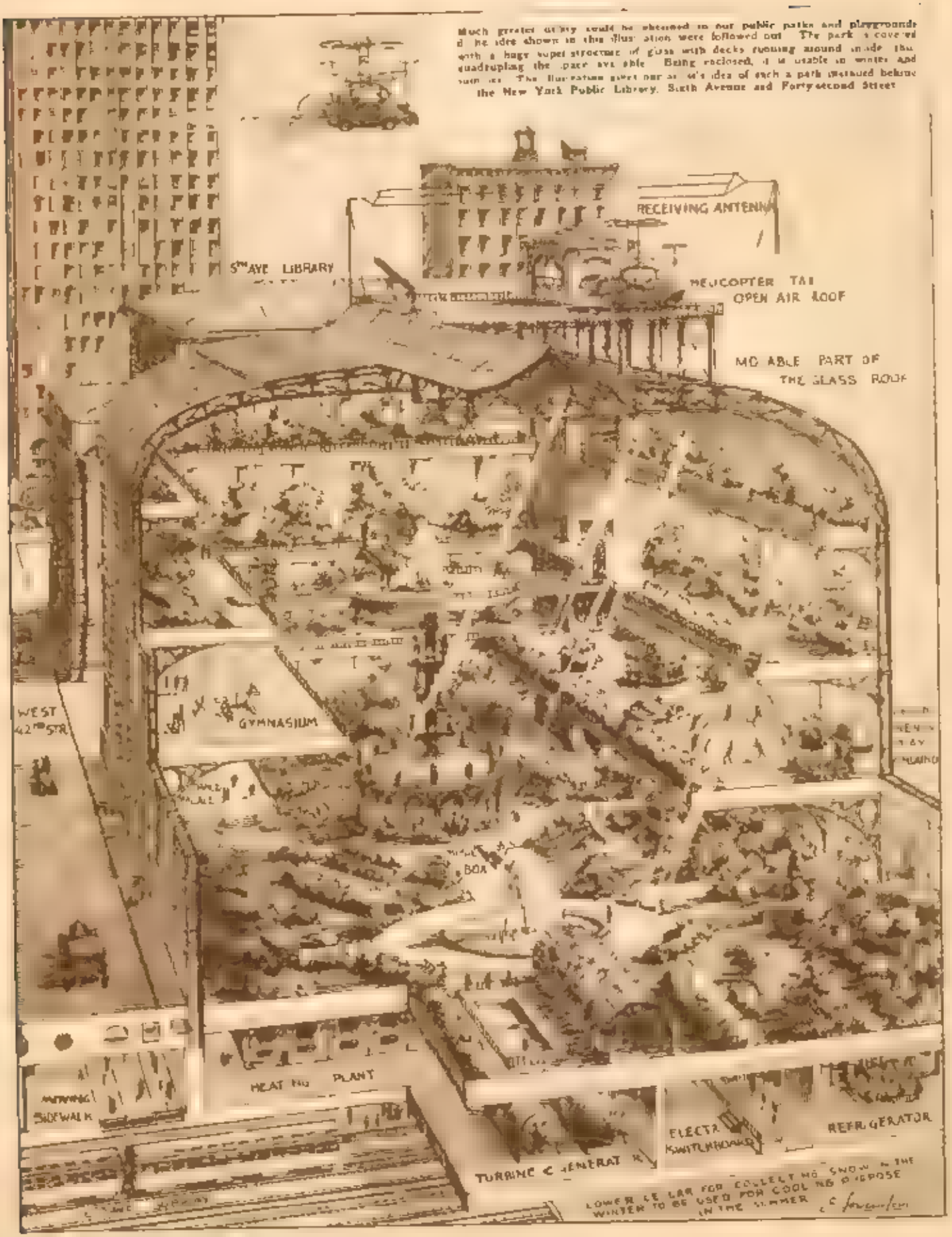



DRIVE SHAFT ATOMIC MOTOR

INTERPLANETARY COMMUNICATION BY ILLUMINATED OCEAN HIGHWAYS

THE USE OF GLASS IN ARCHITECTURE

# Skyscraper Park



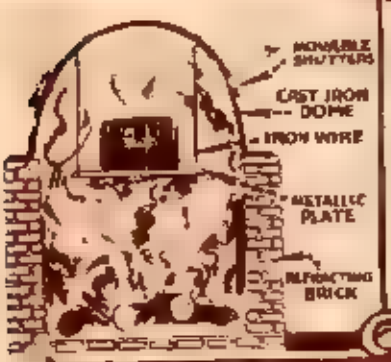

Much greater utility could be obtained in our public parks and playgrounds if the idea shown in the illustration were followed out. The park is covered with a huge super structure of glass with decks running around inside thus quadrupling the space available. Being enclosed, it is usable in winter and summer as well. The illustration gives one an idea of such a park situated behind the New York Public Library, Sixth Avenue and Forty-second Street.

# Cremation—A Modern Science

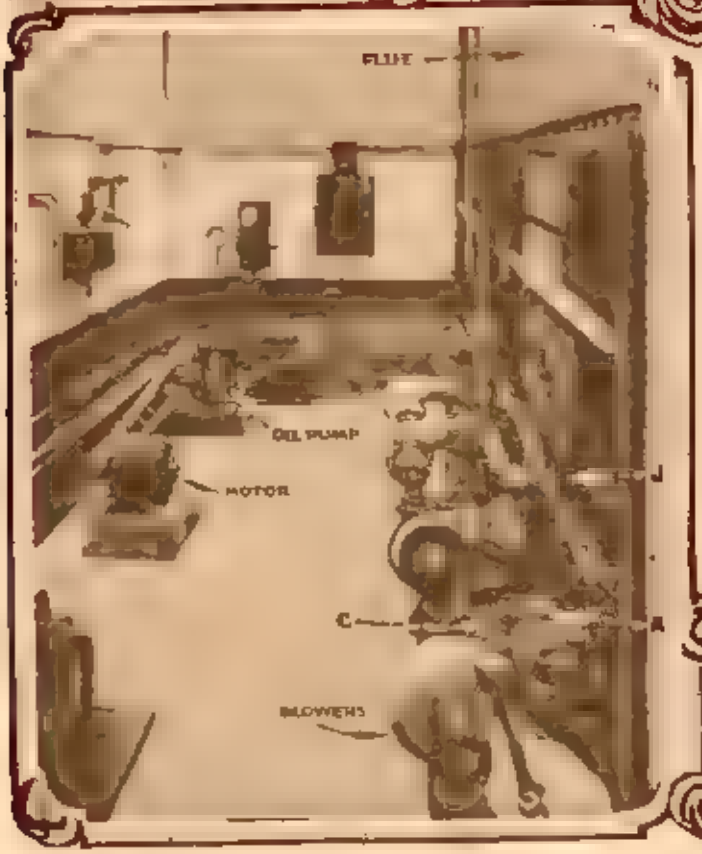
BY SHERA HARGREAVES

Even the earliest recorded history indicates that primitive peoples had crude ideas of sanitation and they practiced cremation during pestilences and after battles. But cremation was just the lesser of two evils. The ancient funeral pyre was not only extremely unsanitary but was abhorrent to the senses. There are vague ideas current as to the method by which cremation is effected today, and much of the prejudices against incineration arises because of this mistaken assertion that cremation still clings to its ancient form. Nothing could be farther from the truth. It is a science.

The above photo shows casket chamber in modern Moore retort. This measures 6 ft. 6 in. by two feet eight inches by nine feet. The walls and roof are of fire brick and the floor of especially prepared fire tile. The combustion chamber underneath is equipped with two oil burners and the hot gases enter through an aperture in the side walls, travel past the casket and thence up the smoke stacks. The diagram below explains the action. A grooved channel in the sloping floor separates coffin metal from the ashes.




The cremation movement proper was ushered in during the latter part of the nineteenth century. The modern type of crematoria was devised by Prof. Brunetti of the University of Padua, who exhibited a model of his apparatus in Vienna in 1873. Cremation societies sprung up at once both in America and in Europe. This type of apparatus is illustrated at the left. The crematory was used in the open air and is known as the direct fire type. Incineration was complete in four hours.



The photo above shows the ornate chapel in the Moore crematory. Cremation is accomplished in this modern retort in one hour. It cannot be said that the human organism is burned in any retort. The organism is 85 to 90 per cent water and the remaining 10 to 15 per cent comprises the element of earth and air with calcium predominating.

The process of dissolution is always by combustion of gases whether this be brought about in a short hour by heat or slowly by the processes of decay underground or worse yet by the arrested decomposition occurring in the mausoleum crypt. The photo at the left shows the works of a modern crematory. The apparatus is so noiseless in operation that the phones at the back may be used at any time. C indicates the oil controlling valve, and A the air pipe while J is the main oil supply line.

# Drainage Map of Mars

Mr George A Burger of Denver, Colorado, working from the absorption assumption, has brought forward the interesting and probably correct solution of the mystery of Mars. Years ago, Professor Lowell discovered some mysterious triangular markings plainly seen in the above map on the edge of the Martian seas. Not knowing what they were, he called them "carets" from their shape Most of the prominent canals end in these peculiar formations. Mr Burger suggests that the "canals" are merely river valleys whose black soil makes them prominent against the arid red soil of the rest of the planet, even as our own little Mississippi valley would stand out in contrast with the reddish brown of the Great Plains Mr Burger believes that the carets are abandoned river deltas The conclusion is well supported and has an important relation to the question of habitability of the planet

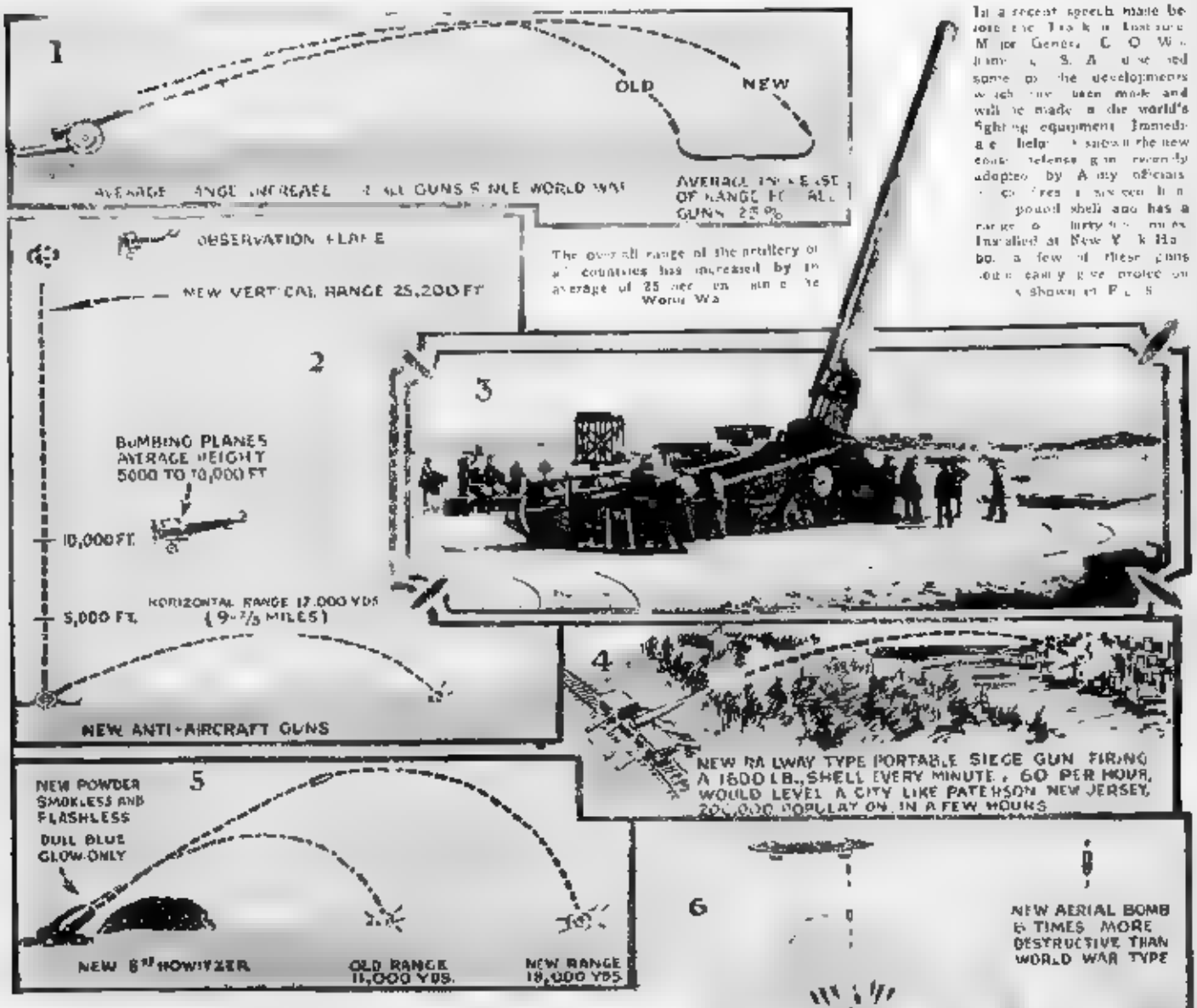
# How Our Earth May Dry Up

The presence of organic mud proves that vegetation has existed on the planet within recent geological times Otherwise the black mud and terrace valleys would have vanished ages ago into the red soil just as surely as the once fertile country near the petrified forest in Arizona now only exhibits barren sand It is possible that some of the lower forms of life, fungus, lichens, etc., still live there but any animal life which existed while Mars was in its prime has probably vanished

As Mars absorbs its oceans is it not possible that the Earth when it cools still more will do the same? The above shows the configurations of our Earth when it reaches the stage where Mars is now The abandoned deltas the dried oceans the small black holes in the most of the empty seas, drainage systems, where the last vestige of water will disappear from the surface of the earth

# The Next War's Ordnance

By H. WINFIELD SCOR




In a recent speech made before the Tank Corps Major General C. O. Williams, U. S. A. revealed some of the developments which have been made and will be made in the world's fighting equipment. Immediately below is shown the new coast defense gun recently adopted by Army officials [illegible] fires a shell [illegible] pound shell and has a range of thirty-five miles. Installed at New York Harbor, a few of these guns could easily give protection as shown at Fig. 8.

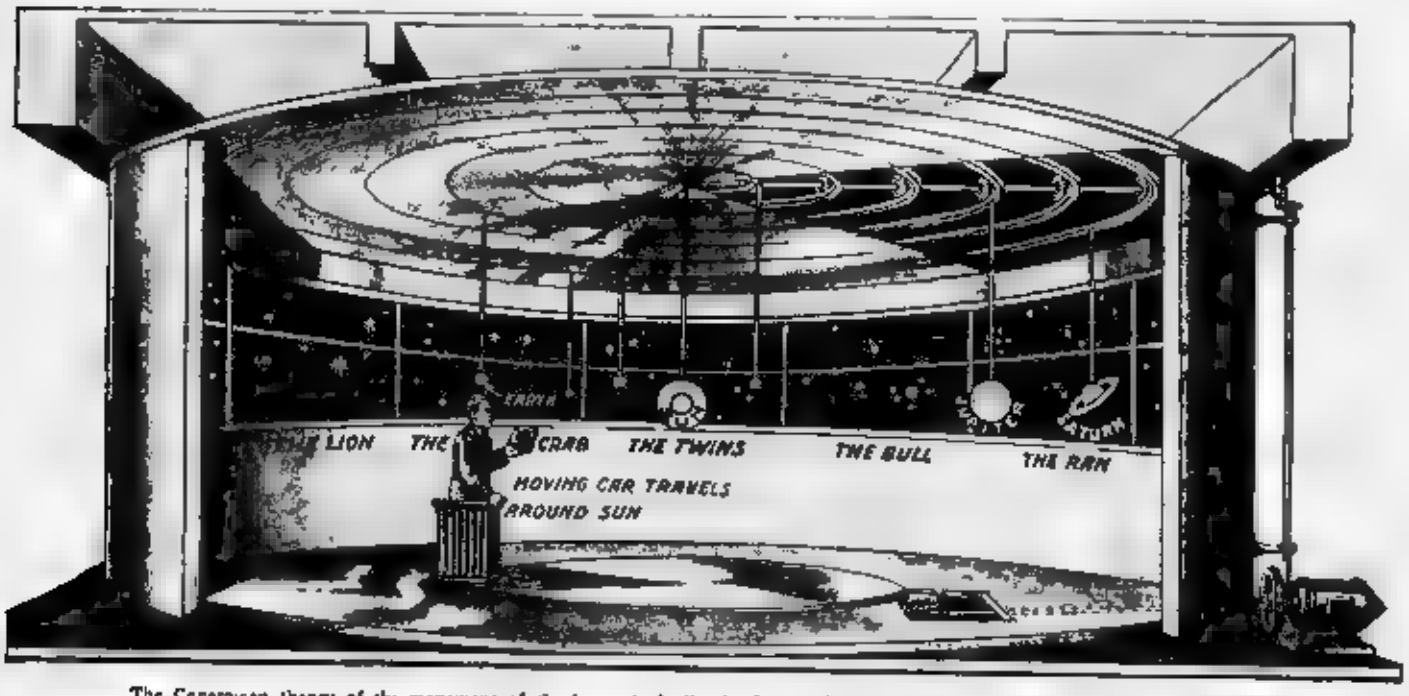
The overall range of the artillery of all countries has increased by an average of 25 per cent since the World War.

At 2 is graphically illustrated the newest anti-aircraft gun with a vertical range of 25,200 feet. This gives protection from bombing planes and to some extent from observers. When the bomber rises above 10,000 feet his work ceases to be effective. At 5 he horizontal setting, this gun has a range of almost 10 miles. At 5 is shown the latest development in howitzers for use in close demolition. It fires an 8 inch projectile and uses a new powder which is quite smokeless and flashless. It burns with a dull blue glow.

Aerial bombing has thoroughly established itself for siege tactics. The latest developments along this line are given in illustration 6. An aerial bomb six times more destructive than any used during the World War is one of the greatest advances along this line. At the left in Fig. 7 is shown a photograph of shell for new gun pictured in the photograph at 3. At 8 the map shows clearly how the long range guns would give ample protection against an enemy fleet for New York City.

# Old Ptolemy's Planetary Idea

With the spires and towers of Munich's skyline as a background all the planets, the constellations, the sun and the moon travel through the huge blue dome representing the heavens in the great Ptolemaic planetarium at the Munich Museum.




The Copernican theory of the movement of the heavenly bodies is shown with the sun in the center of the planetary system through another planetarium of the Museum. As a result of its size and careful engineering its movements are almost perfect.

THE worthy ancients who studied at the feet of Ptolemy, had an explanation of the movement of the heavenly bodies that was interesting if not correct. They considered the earth the center of the universe around which all the bodies traveled. In order to show clearly their conception, the Munich Museum has erected a huge planetarium working according to their theory. From projectors on a pedestal beams of light representing the moon, planets and constellations travel around a 27-foot hemisphere which represents the heavens. The projectors are all connected mechanically and a small electric motor revolves them through timing gears. Nearby, there is a more elaborate planetarium of the Copernican system—the correct system as conceived today—with the planets revolving around the sun and the constellations painted on the wall. Also, the satellites of each planet are shown. A system of gears back of the ceiling above the thirty-foot housing of the apparatus drives the planets around the sun. Each planet is equipped with a cycle regulator, electrically operated, which corrects its motion every five seconds so it is impossible for discrepancies to appear. In the Ptolemaic planetarium the heavens perform a day's circuit in four minutes. In the Copernican apparatus the earth completes a year's revolution around the sun in ten minutes. Also students may hasten the movements of the astronomical bodies. The observer can rotate in a box with and just under the earth.

January

25 Cents

# Science and Invention

IN PICTURES

EXPERIMENTER PUBLISHING COMPANY, NEW YORK, PUBLISHERS OF
RADIO NEWS - SCIENCE & INVENTION - THE EXPERIMENTER - MOTOR CAMPER & TOURIST

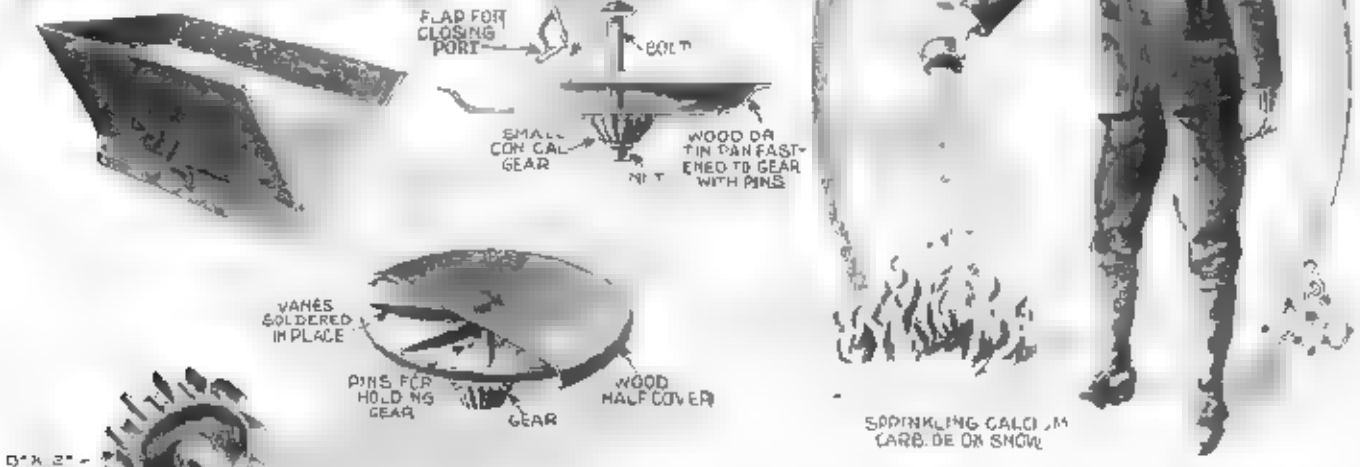
# The Snow Burner

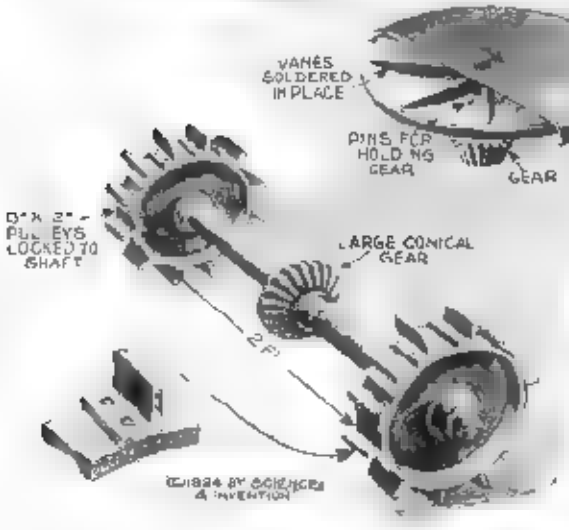
By JOSEPH H. KRALS

## A New Scheme for Clearing Snow from Sidewalks

A simple experiment for seemingly burning snow is illustrated in the above drawing. A hole is first poked into the snow with the finger or with a stick. A piece of calcium carbide is then dropped into the hole and snow packed lightly on top of the calcium carbide. The moisture present in the snow causes the calcium carbide to go into chemical reaction with the water and evolve acetylene which burns on the surface of the snow when ignited. The heat so evolved will melt the snow and the heat of reaction will further aid the melting of the snow.

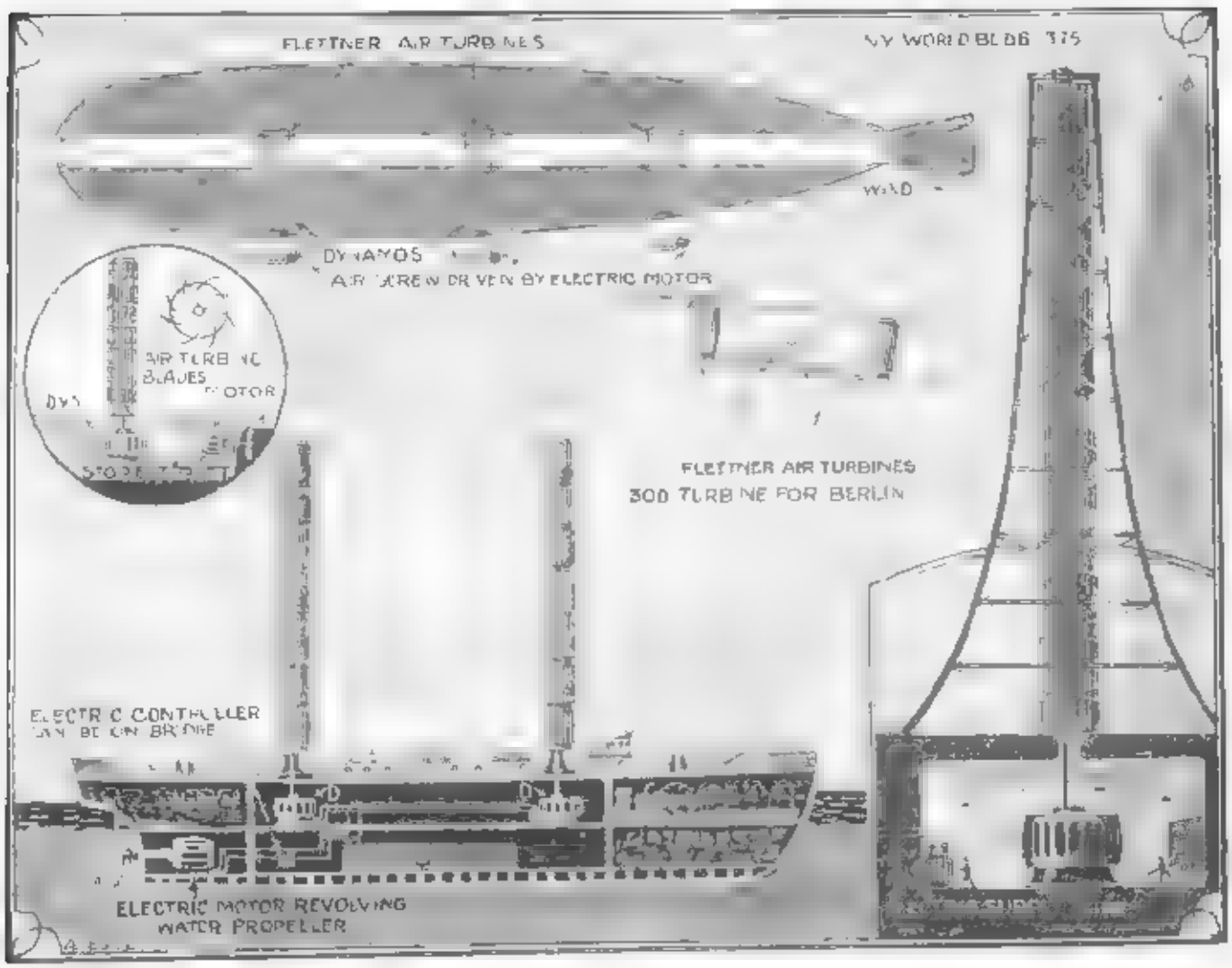
Based on the principle of the experiment illustrated in the upper right hand corner of this page, the suggestion for the experiment having been made by Harry E. Hale, the snow burner illustrated above has been devised. Essentially this consists of a means of sprinkling calcium carbide upon snow, and as the gas is evolved, to ignite it with a match. The sprinkler is then drawn over the walks, and the flames follow in a wake melting the snow which runs off in the form of water.




**Great care must be exercised in sprinkling calcium carbide upon snow, so that when the gas is evolved and ignited it will not set fire to shrubbery, trees or the house itself. Under no conditions should such a snow remover be used when a gale is blowing, and the individual drawing the machine over the road should always see to it that he heads into any slight breeze which may be blowing, so that his own clothes will not be ignited. A slow procedure is best because a large area of snow will not be heated at one time and the flame area is considerably confined. Above and to the left the principal parts of the mechanism are illustrated. It will be noted that a hopper containing calcium carbide slowly drops the carbide into a pan revolving at high speed. The pan is covered on the front half by a shield so that the carbide sprinkled out because of centrifugal force will only fall in back of the mechanism. For illuminating small patches of snow, the best system is to sprinkle the carbide out of a pan, as illustrated above.**

# Sail-less, Engine-less Ships

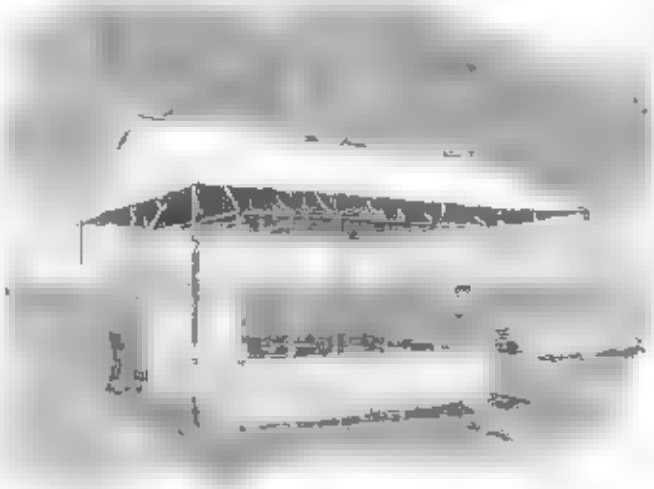



Announcement has just been made by Anton Flettner that he will attempt to sail a sailless ship across the Atlantic. The ship is to be fitted with two revolving cylinders each sixty feet high which are in reality highly efficient air turbines connected to dynamos. By which in turn to supply current to storage batteries. Hence to electric motors coupled to the propeller. The illustration also shows the simplest view of the Flettner turbine coupled with the dynamo, storage battery and motor. The method is applicable not only to vessels, but also to airships and airplanes where the size of the Flettner turbines would be cut down considerably but a greater number would be used to turn dynamos which supply the motors could of course be dropped with the necessary wires remaining. Strange as it may seem it is absolutely possible to propel a ship of this kind which will sail faster than the wind. There is power in wind as anyone who has sailed knows but the wind power is not used more efficiently and correctly only because of the old fashioned scheme. The proposed sailless ship will be 300 feet high comparable to the World Building in N. Y. City.

# Building Houses While It Rains

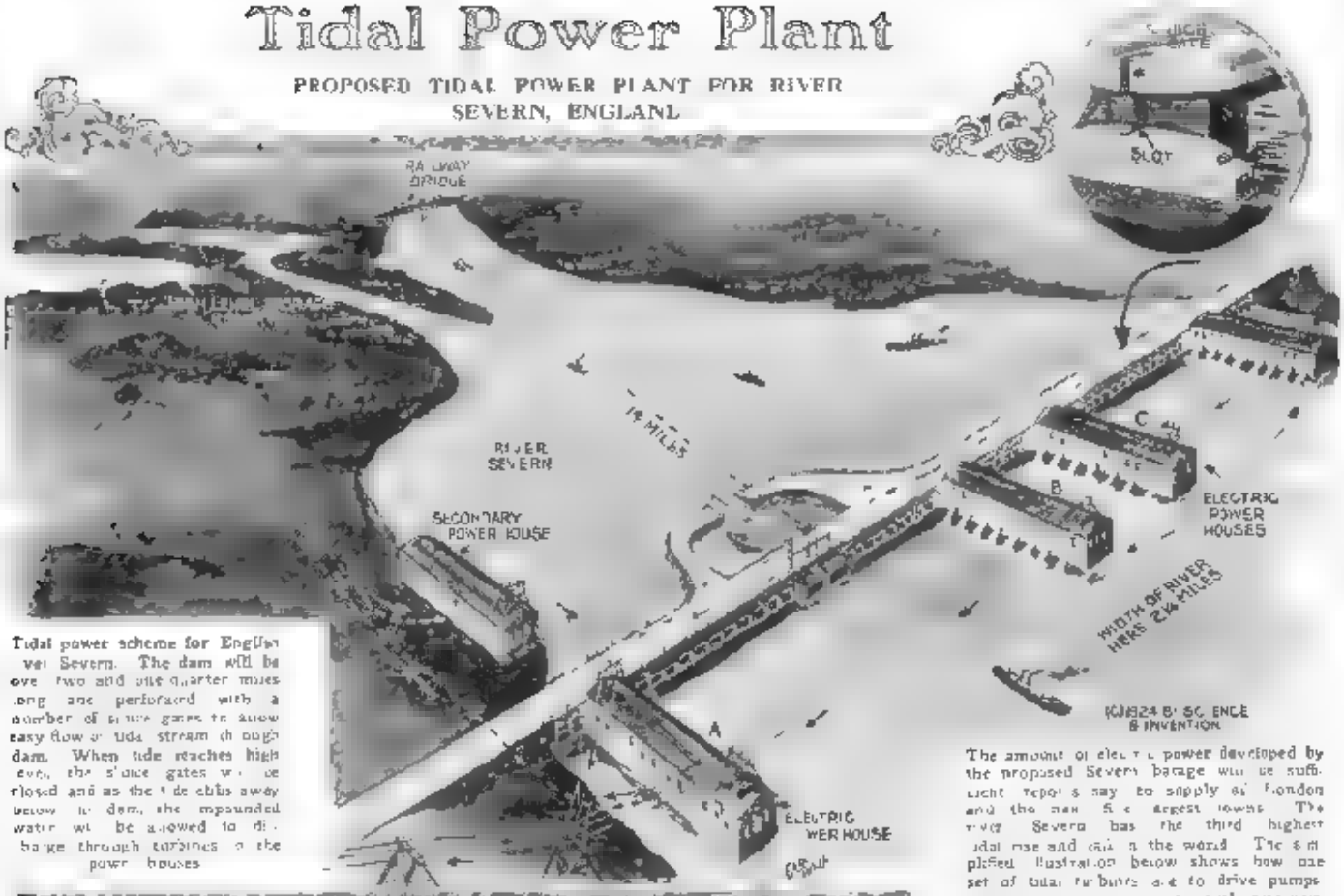
Why not erect a large tent big enough to house the building complete so that work need not be interrupted during a rainy spell suggests the author. Such a tent might cost $500 but considering that labor costs $9 a day and requires six men six months to build a $10,000 bungalow it would often pay well to use a tent. Besides the cost of the tent would be saved on shingles, painting and would be considered

Kansas City Star Photo No. 1 22



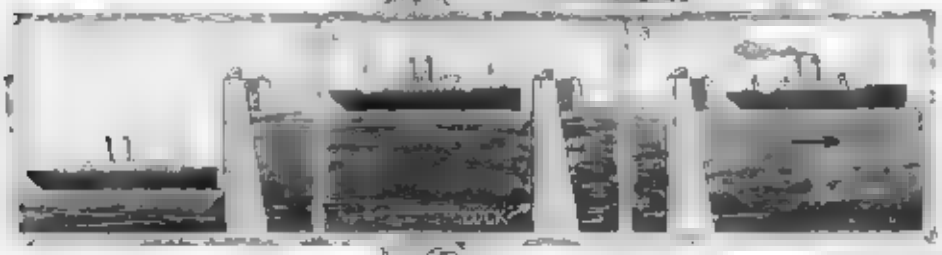
# Tidal Power Plant

## PROPOSED TIDAL POWER PLANT FOR RIVER SEVERN, ENGLAND

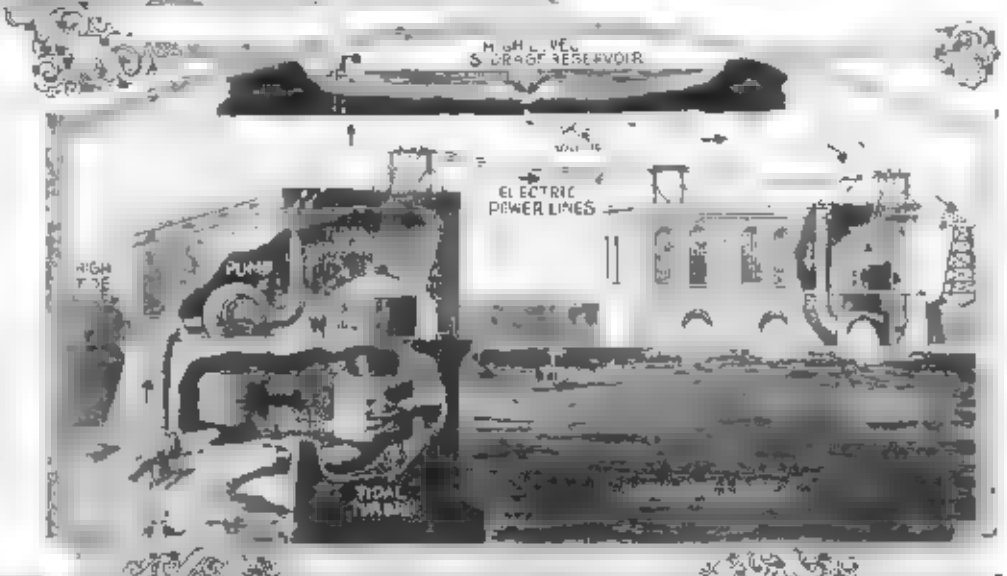



**Tidal power scheme for English river Severn.** The dam will be over two and one quarter miles long and perforated with a number of sluice gates to allow easy flow of tidal stream through dam. When tide reaches high level the sluice gates will be closed and as the tide ebbs away below the dam, the impounded water will be allowed to discharge through turbines in the power houses.

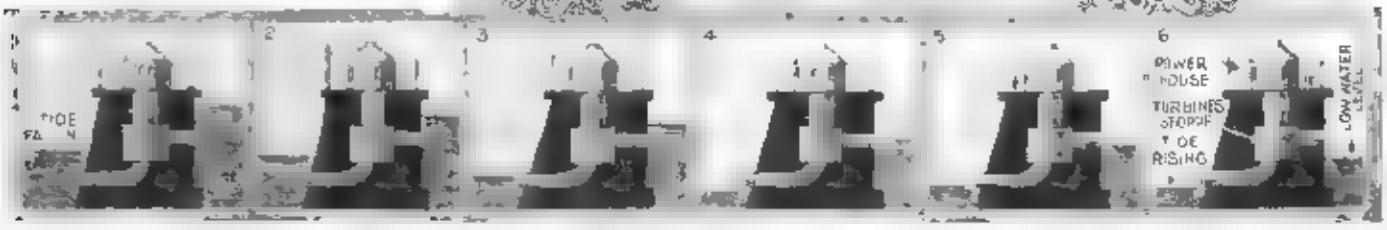
The amount of electric power developed by the proposed Severn barrage will be sufficient reports say to supply all London and the near Six largest towns. The river Severn has the third highest tidal rise and fall in the world. The simplified illustration below shows how one set of tidal turbines are to drive pumps storing water in a high level reservoir water from this reservoir being used to operate dynamo turbines when there is no tidal power available from the main power houses situated along the dam. This is when the sluice gates are shut and all of the impounded water above the dam has been passed through the turbines. The auxiliary high level storage reservoir will be attached through the intermediary of the secondary power house so keep the supply of electric current continuous.



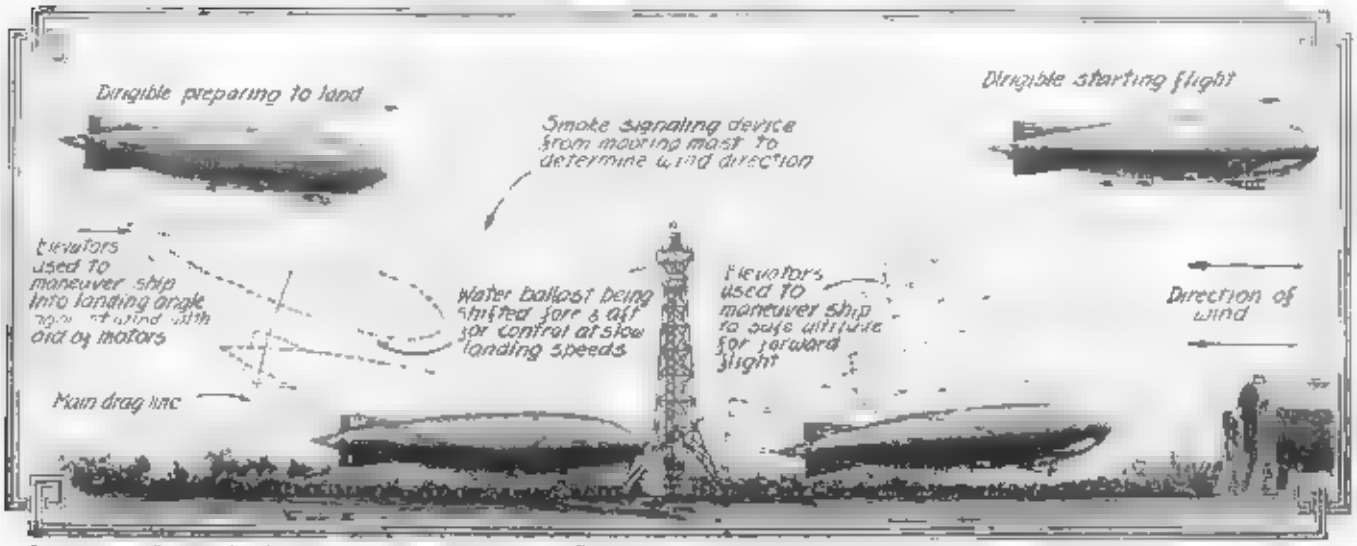

The three small drawings numbered one to three above show how ships will be worked through the Severn power dam. Fig. 1 shows a ship entering the opening through dam into lock in which the water is at the same level as that on the down stream side of the dam. Fig. 2 shows water level in lock raised so that ship is at same level as impounded water above the dam. Fig. 3 shows ship passing out of lock gates into impounded or upstream waters.



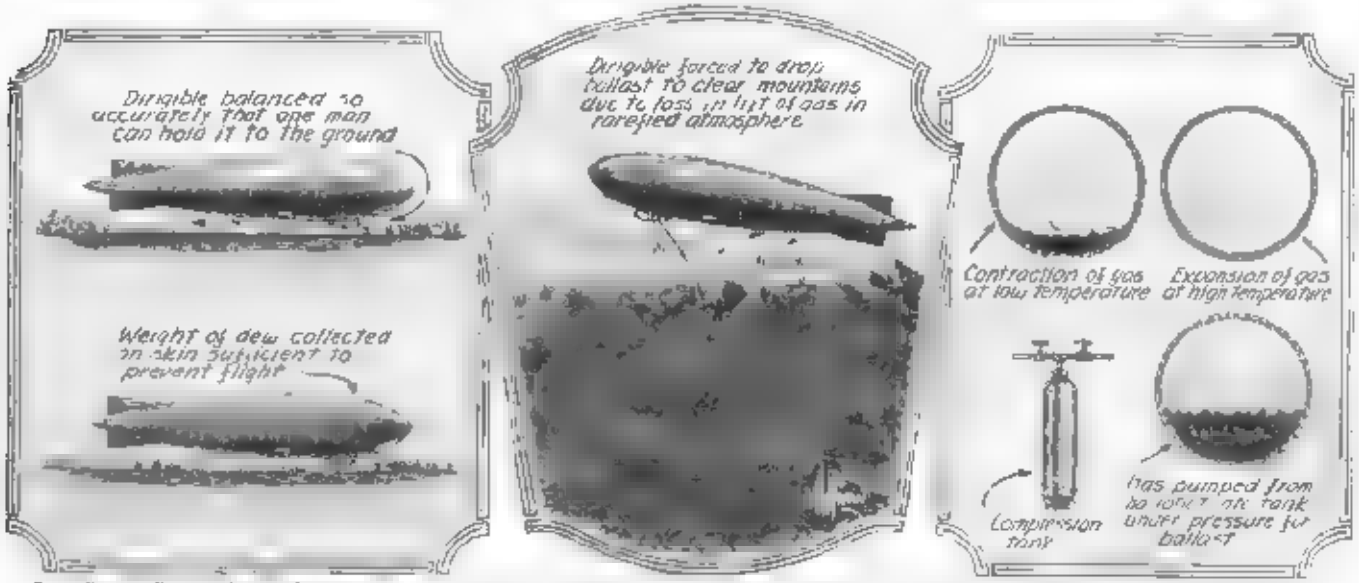

The six numbered progressive views below shows in a clear manner how tidal turbines operate. On top of each tidal turbine there is a dynamo which spins with the turbine blades and develops electric power. Fig. 1 shows one of the turbines casing so work will inside of it being below dam. Fig. 2 shows turbine working at full power. Figs. 3 and 4 showing the same operation while Fig. 5 shows turbine preparing to stop. Fig. 6 shows turbine stopped while tide rises.



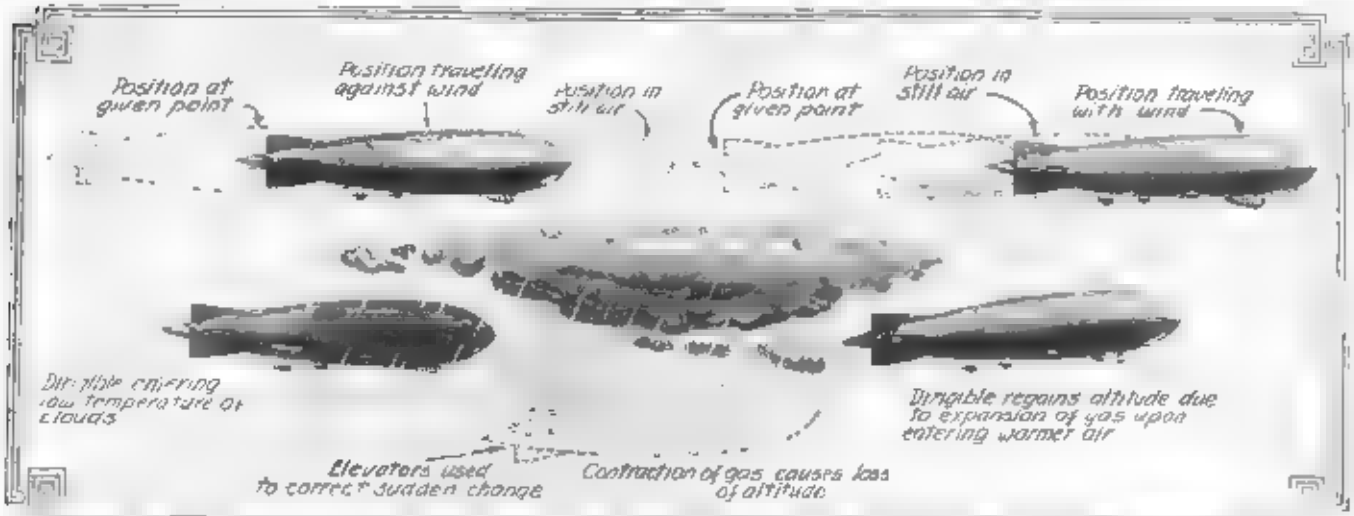
# Little-Known Dirigible Facts




In landing a dirigible the ship does not ordinarily valve gas. The vessel is first maneuvered against the wind with the aid of her motors, a dragline dropped and eventually the ship is brought to its landing position. In starting a flight, the propellers are permitted to turn over at a speed just sufficient to overcome the velocity of the wind, so that the vessel rises almost vertically



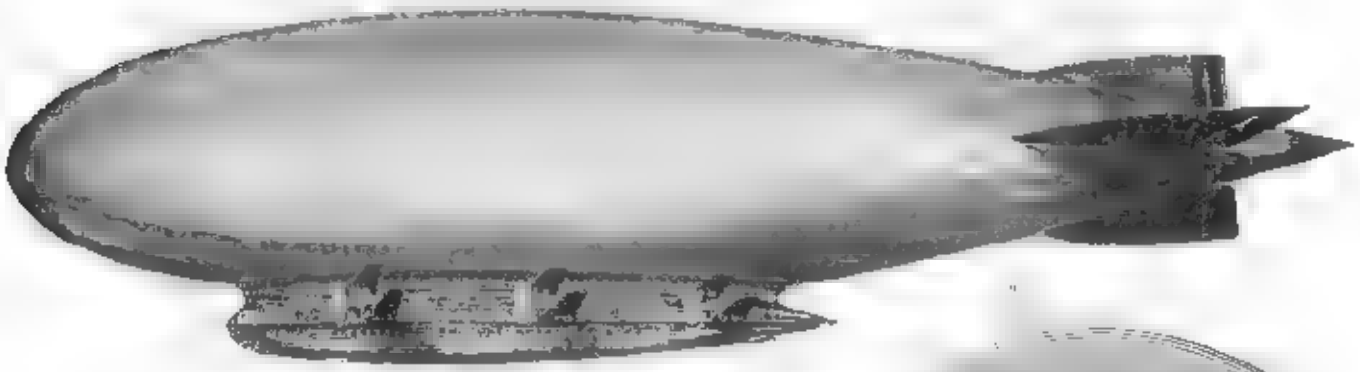

So well can a dirigible be balanced that one man can hold it to the ground when it has a crew on board. It even becomes impossible to start a flight in the early morning after a heavy dew fall as the weight of the dew is too heavy to permit the ship to take off. The section at the right shows the effect on balloons of the difference in temperature. Gas under compression is used as ballast

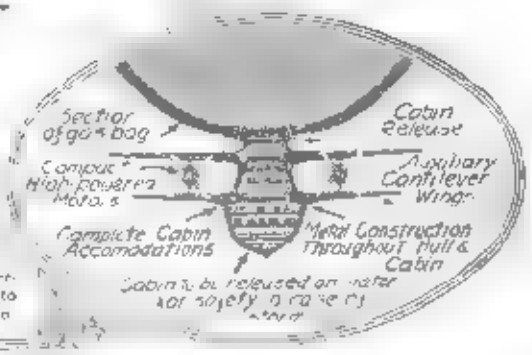



The above diagram illustrates how the wind affects the flight of a dirigible. The shaded illustration shows the position of the ship traveling with and against the wind. Notice how this vessel will return to its starting point. It is remarkable to see how rapidly a dirigible will sink when a gas bag is chilled by a cloud. The heat from the sun is cut off, the gas contracts, and buoyancy is greatly lessened almost instantaneously. This drop is partially corrected by the elevating planes.

—William P. Sullivan, Aeronautical Engineer.

# Safety Dirigible of the Future



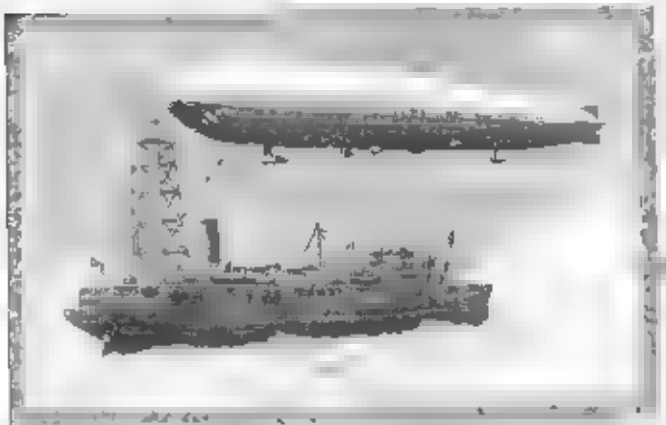



If trouble develops with the gas bag of the future dirigible the passenger and engine compartments can be released therefrom and will help plane to earth. The wings may be flexible to assist with steering and the bag and the compartments will float on water. — Von Stein

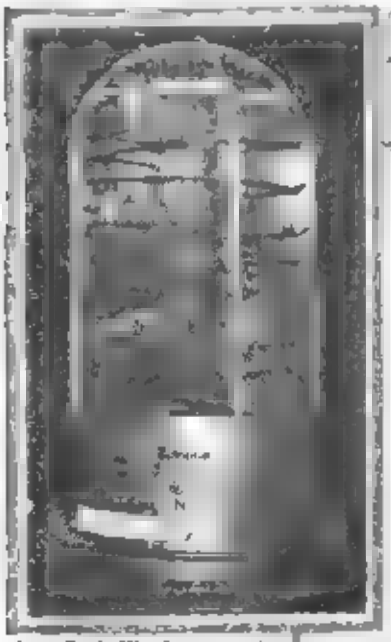
## Airship Moored to Boat

To the April 1926 issue of SCIENCE AND INVENTION we published what is known among artists as a "sketch" drawing showing a large dirigible moored to a structural steel mast which was erected on an ocean going tank ship. This demonstration was used in connection with an article by Grover Schornsheimer, our naval writer, dealing with the mooring of ships. Several drawings are reproduced at the left. A that a mooring mast for a dirigible anchorage for a dirigible had been built but was merely a theoretical stage. However the tanker Patoka has since been converted and its appearance differs very little from that set forth in our article many months ago. The photograph directly below shows the Shenandoah moored at lakehurst actual working conditions and shows the Shenandoah moored at her base. [illegible] SCIENCE AND INVENTION was the first to publish such a picture

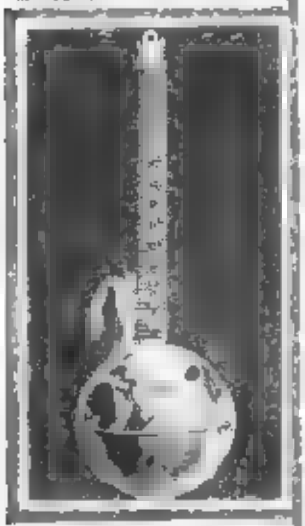
Photo Times Wide World



# Unique Clocks

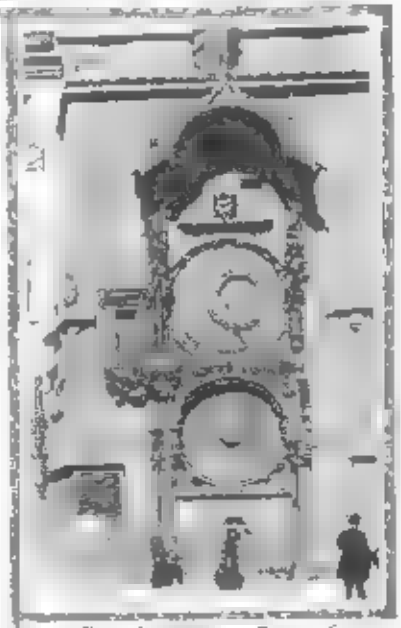


The Fred W Jensen and Son perpetual motion clock (with a motor concealed in the base) is shown above

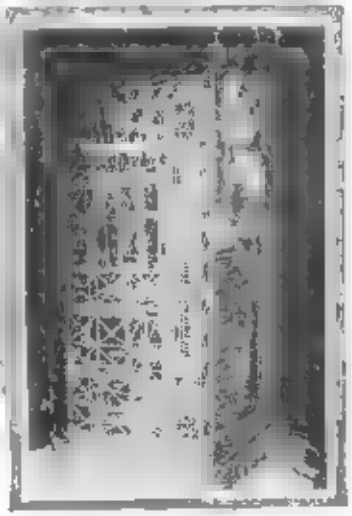


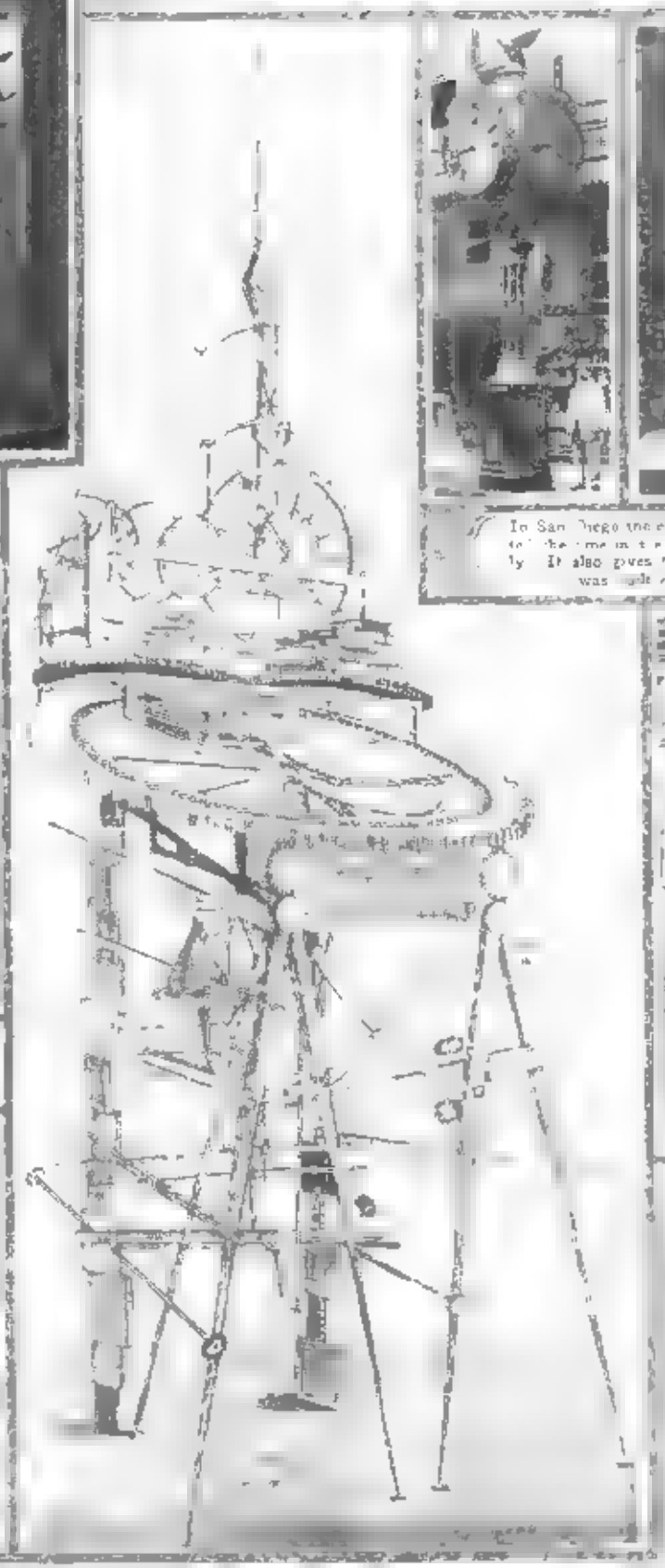
The bas relief above tells time by the pointing of the figure at the pavement strip. Gas is pulls the ball down

In San Diego there is a street clock with twenty dials which tells the time in the principal cities of the world simultaneously. It also gives the day of the week and the month. It was made especially for a retail jewelry store



Town Hall clock at Prague Czecho-Slovakia was built in 1490. It shows mean time, Sidereal time and position of sun. — Scientific American.

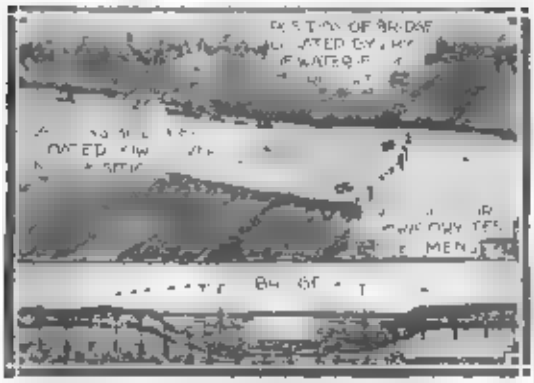


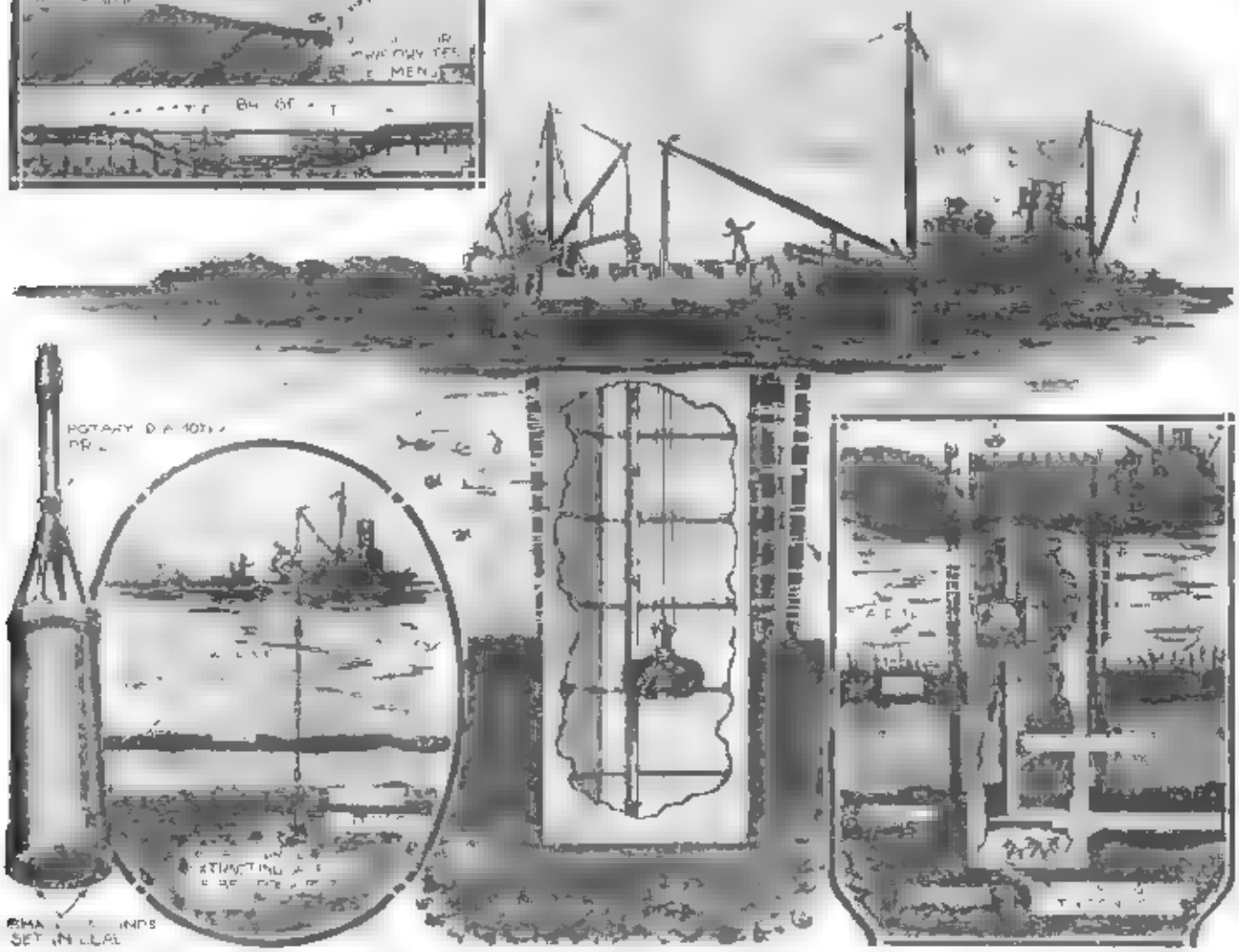


The above illustration gives a view of the famous John Mill clock which he had constructed to light his fireplace in the morning and to regulate his study periods at night by passing the various text-books he was using to the light at the proper time. A large weight hanging at the window actuated his device. At the left above is the clock of Frank Field which is a masterpiece of fifty years of patient work. It is seven feet high and three feet square and has 408 dials showing the time, size, height of government postage stamps and the lowest point and the name of the capital of every country in the world as well as its angular. The globe at the top representing the earth revolves every 24 hours. The moon is shown in comparative size and revolves once every 29 days. At the left is shown the famous straw clock built by a German which contains nothing but straw.

H. F. Zimmerman

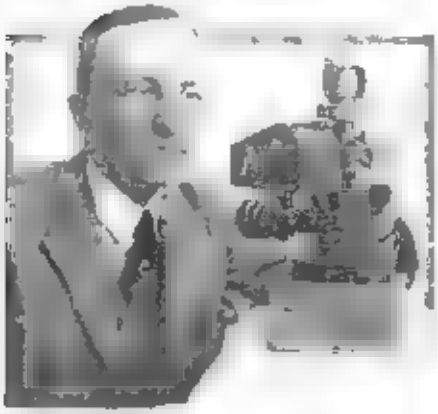
# Building Bridges





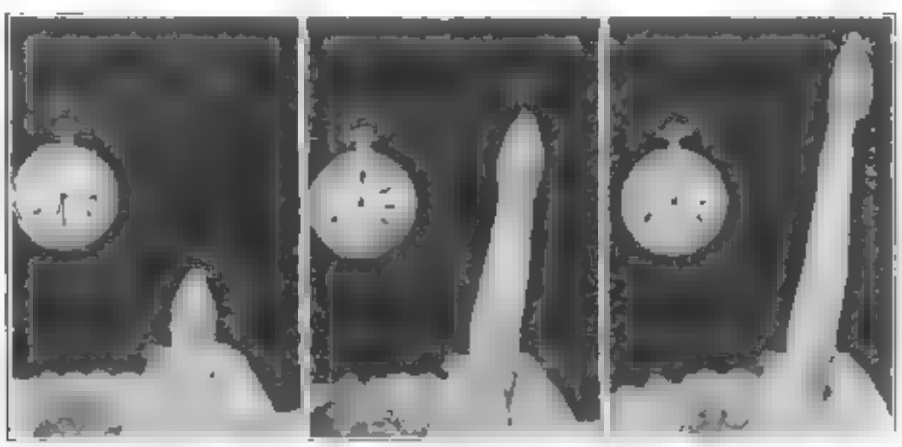
One of the most interesting facts connected with bridge building are the methods employed. Preparations for the construction of a bridge are usually made by sinking caissons over which the bridge is to be built. The hollow cylinder, as drilling diamond or steel shown at the bottom, is a rotary shaving exactly the contour of the rock below. On this knowledge the location of the piers is decided. A caisson is built above the location of the bridge and floated to position where it is sunk. The sand and debris is then dredged out of the inside of the caisson with dredge buckets, until the caisson reaches solid rock. The bottom is then filled with concrete, leaving air locks for the passage of men working at the bottom of the caisson under extra high air pressure. On reaching solid rock the bottom of the caisson is sealed and then the whole filled with concrete. W. B. A.

# Compass



For those parts of the world where the magnetic needle cannot be depended upon, the above compass which finds direction by means of the sun is used. Courtesy Alfred Gradenwitz

# Rapidly Growing Plants



Possibly the most rapidly growing plant known to man is the fungus called Phallus. The above photographs show a specimen and the time taken for it to reach maturity. S. Leonard Bastin

March

25 Cents

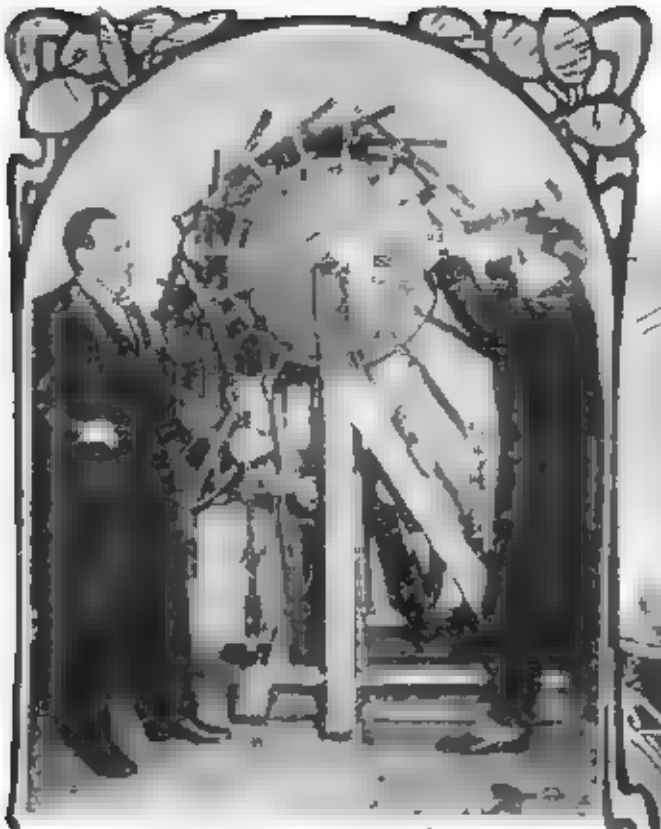
# Science and Invention

40 RADIO ARTICLES

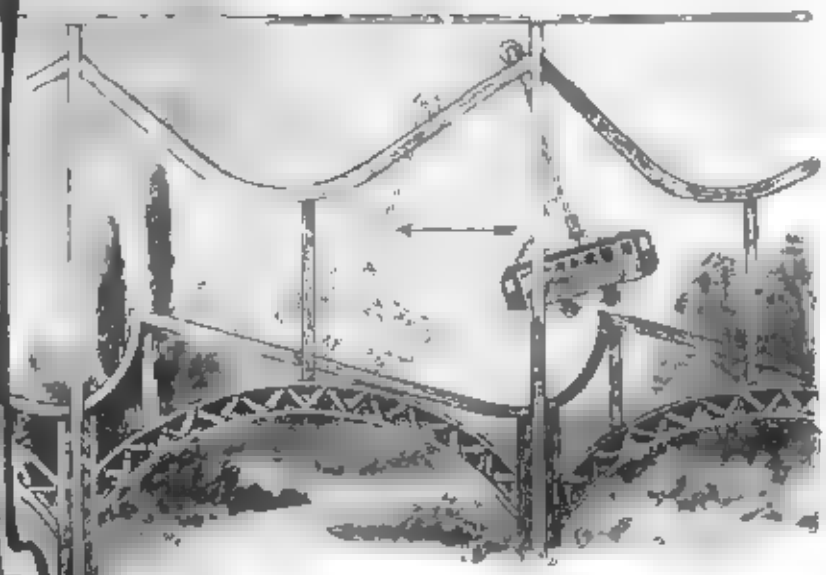
SCIENCE AND INVENTION — THE EXPERIMENTER — MOTOR CAMPER & TOURIST

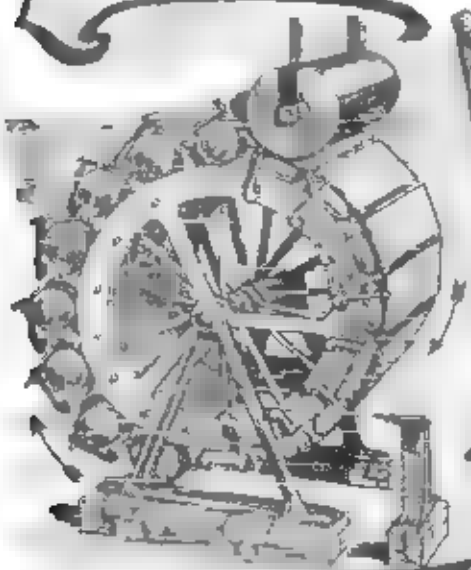
# The Perpetual —$5,000

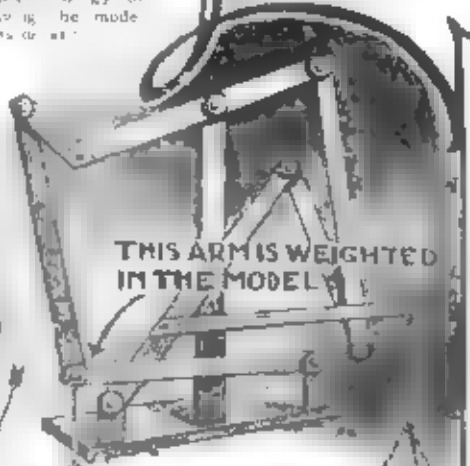
By JOSEPH



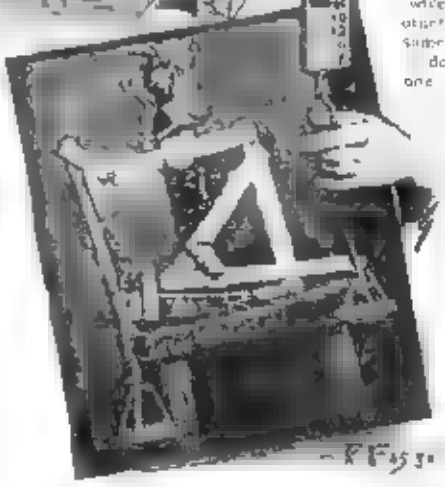
The perpetual motion machine illustrated above was built in Boston and like all other similar devices it did not work and after spending years of labor vainly on building it its inventor gave up and left the model behind. The machine consisted all of iron and





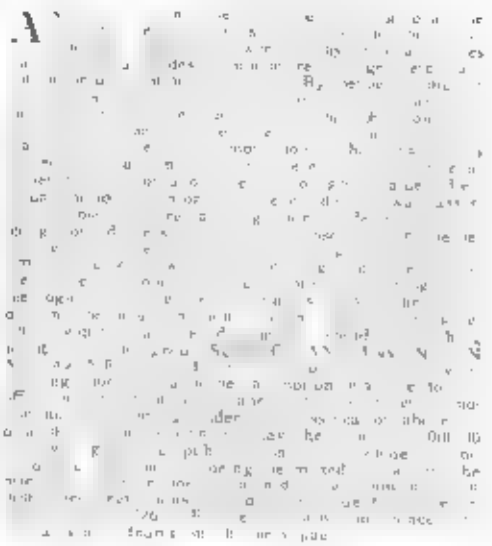


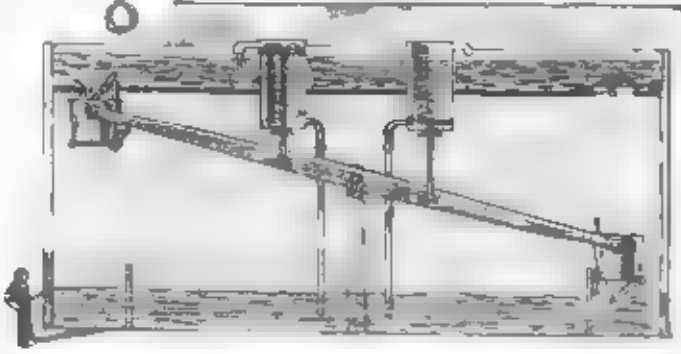

The hoax at Biltmore Asheville N C as shown in the photo at right below is simply a clever trick. It consists of a weight on one side of the pan and a wire as much or the other side through the same arm to make do so, the weights one pair of the balance



The machine above is submerged in water. The balloons on one side are inflated. A roller at the top forces the air from upper balloons to the bottom. Buoyancy of half the wheel makes it turn. The device at the extreme right is an older mechanism working on the water principle. Neither of the two are of any

## $5,000.00 IN PRIZES

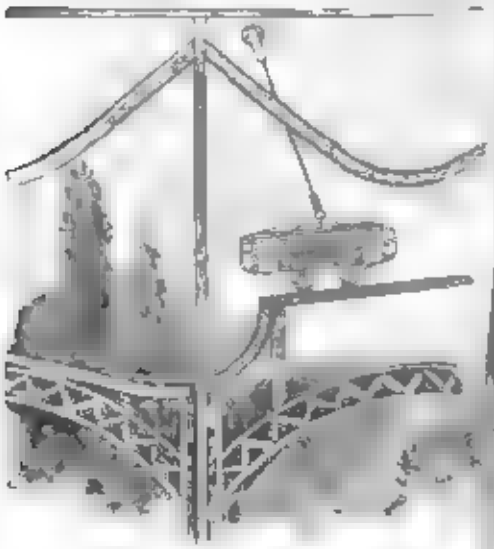




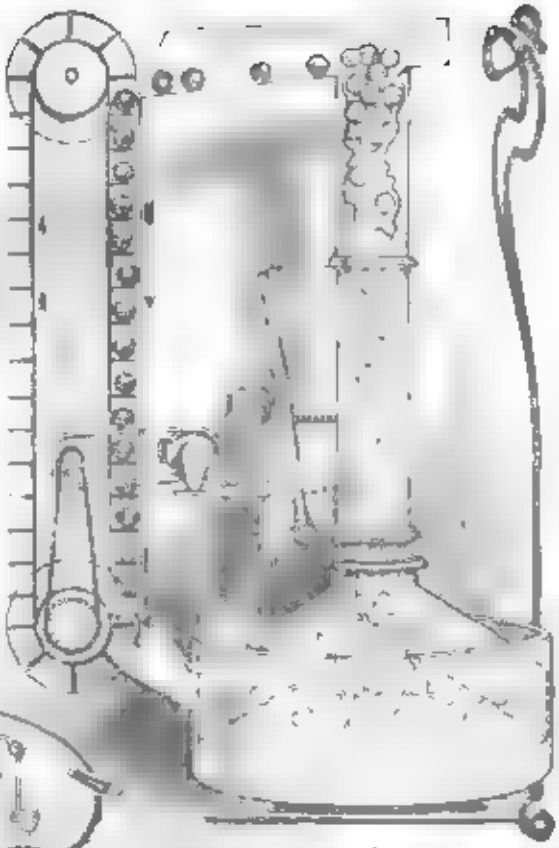
# Motion Myth in Prizes

**H. KRAUS**

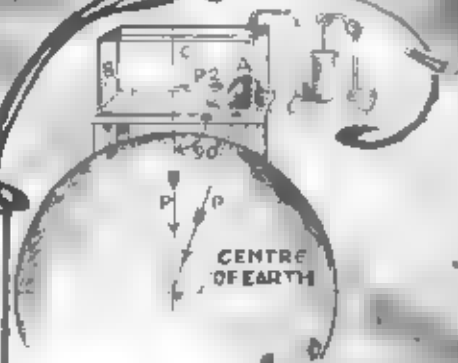
The a way a the left ched d w n l v hen gh e d m n tum the a y at the top f u th m e re ca to the op o h ne ncline The me n m at he b ht p po o ap ra by bo a y a d gravity Ba h a mp on the a e o the v t r se up be cu n of wa e a d descend on the ed es h e t The c e a s and a l and e valves w k ro mat ca y



The automatic aerial railroad depicted above was patented in the U S This would-be perpetual motion device never worked —G Miles



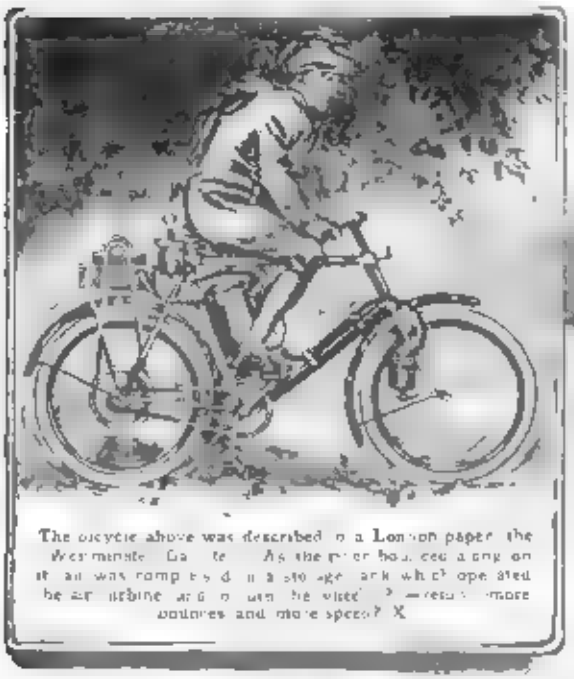
Let a typical ar ver om n p ed rush a news paper proclaiming dis overy o pe pe a motion We wonder how any il or his?



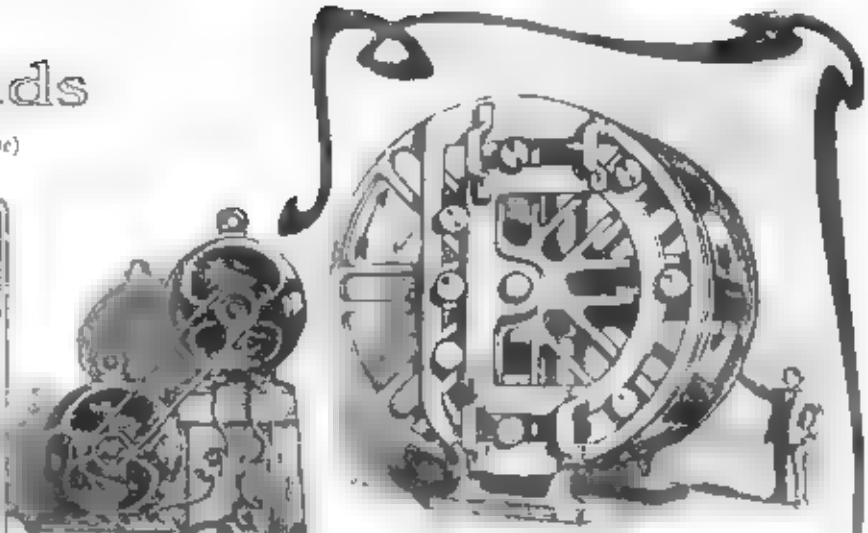

T h e r e h a S C E N C E A D I V E N T I O N M A G A Z I N E B g a d h e m e be o c d e a w A p h e g N e d p o e a w a d N e o h e g A p e o N e a e o h e e e m be o o A p e e e

# More Frauds

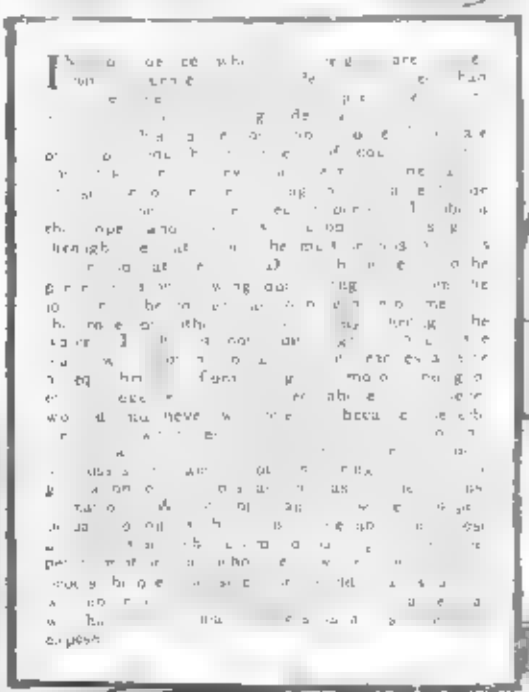
(Continued from preceding page)

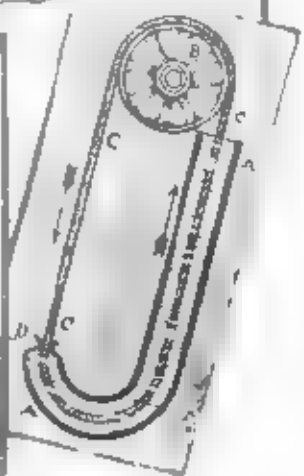


The bicycle above was described in a London paper the Westminster Gazette. As the rider boasted a smoke on it and was competing in a stock exchange walk which depended on the air turbine arrangement he used, it seems reasonable to suppose more postures and more speed? X

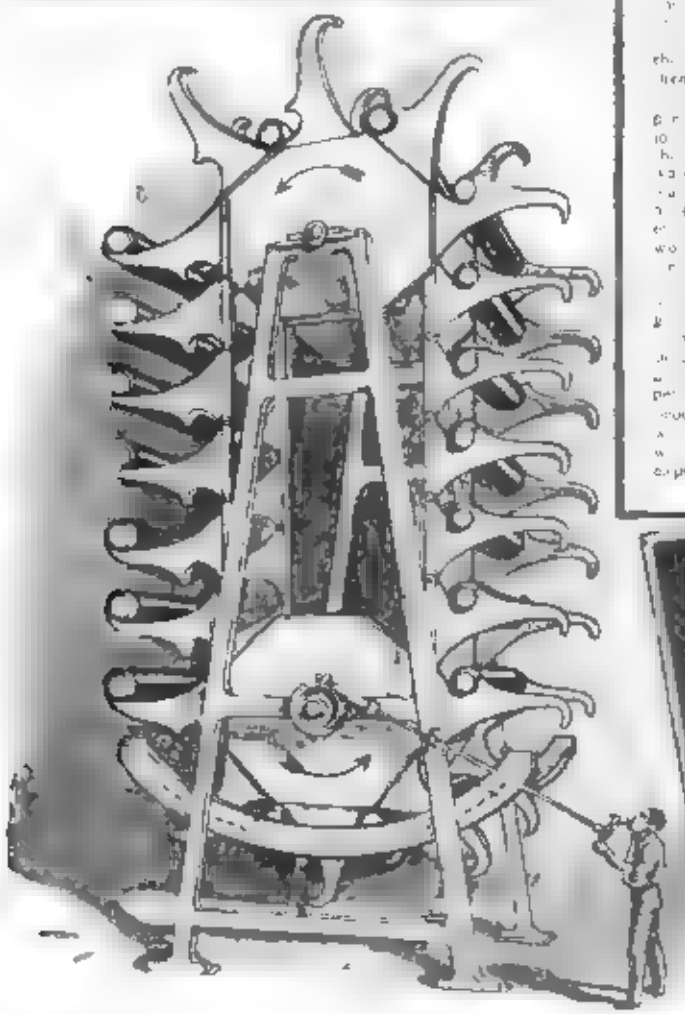


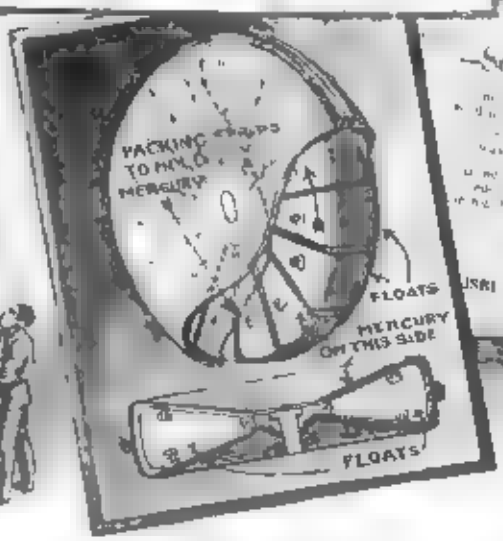
The weights fur thes from the cen er on one de a e Boasbosed to cau e the whee to turn

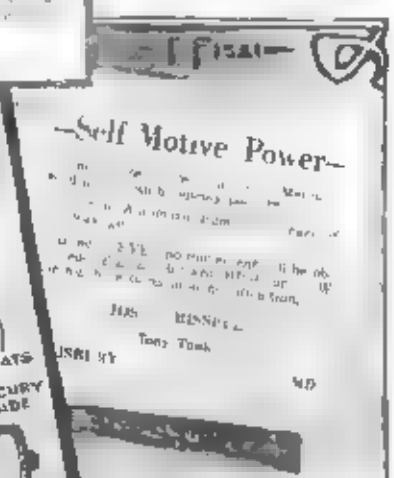




Above A is a column of wa r C is a buo t rope One ide is h ghter than the other but c ion at the end D p vents it from opera g






A patent has actually been taken out on the device above illustrated. The inventor does not state that the device is perpetual motion but that it is to be the start. The machine is equipped with a brake to prevent it from going too fast and the inventor claims a provided with a motor to start it. WITHOUT A MOTOR IT CANNOT WORK

The mechanism above illustrated and the postcard describing it is another self-motive power machine. Mercury is supposedly held on one side of the wheel by packing strips and the other side is empty. The inventor does not consider the mercury as falling from the packing strips which are to hold the mercury in place. The device is inoperative

# New York 100

By H W

A GREAT metropolitan city like New York will of course grow to an unbelievable proportion in a century, or even half that time, and the pictures herewith will help to convey some idea as to how experts believe the foremost city of America will expand in the next century. At the left we have an interesting perspective picture of "little old New York" at the dawn of the nineteenth century, when the population comprised about 60,000 people, a city about one-half the size of Trenton, or Trenton, N. J. today. New York in that day, 1800, extended northward about a mile from the Battery or southernmost point of Manhattan Island, as shown in the picture. The rest of Manhattan Island was occupied by farms, while ships from Europe and other parts of the world were berthed at docks as far up as Canal Street. The present streets of the principal villages of today as well as Central Park, are indicated by the dotted lines.

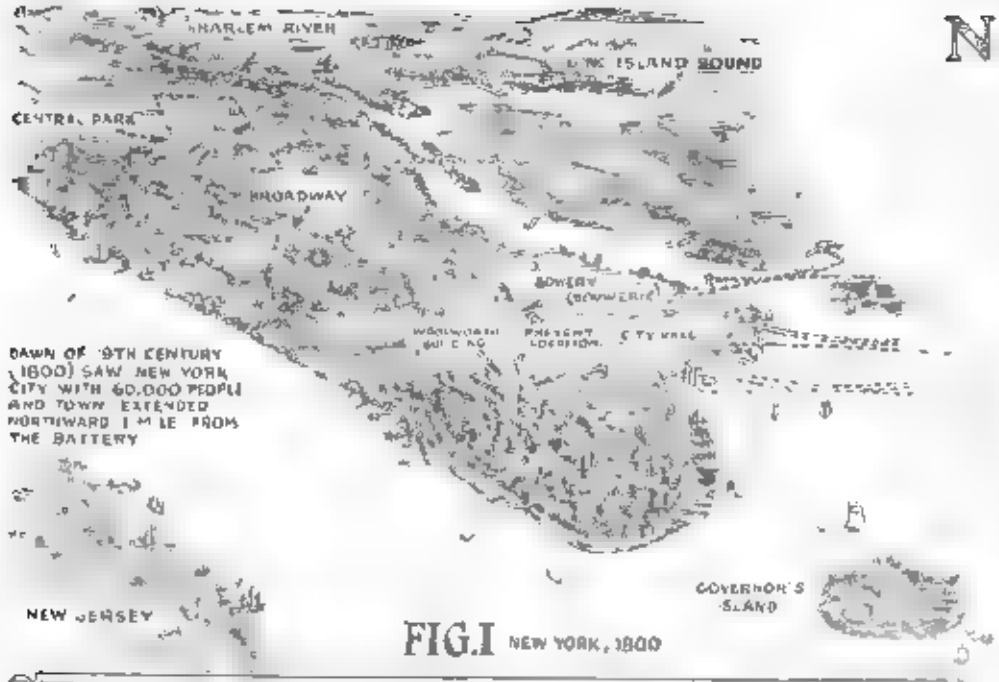
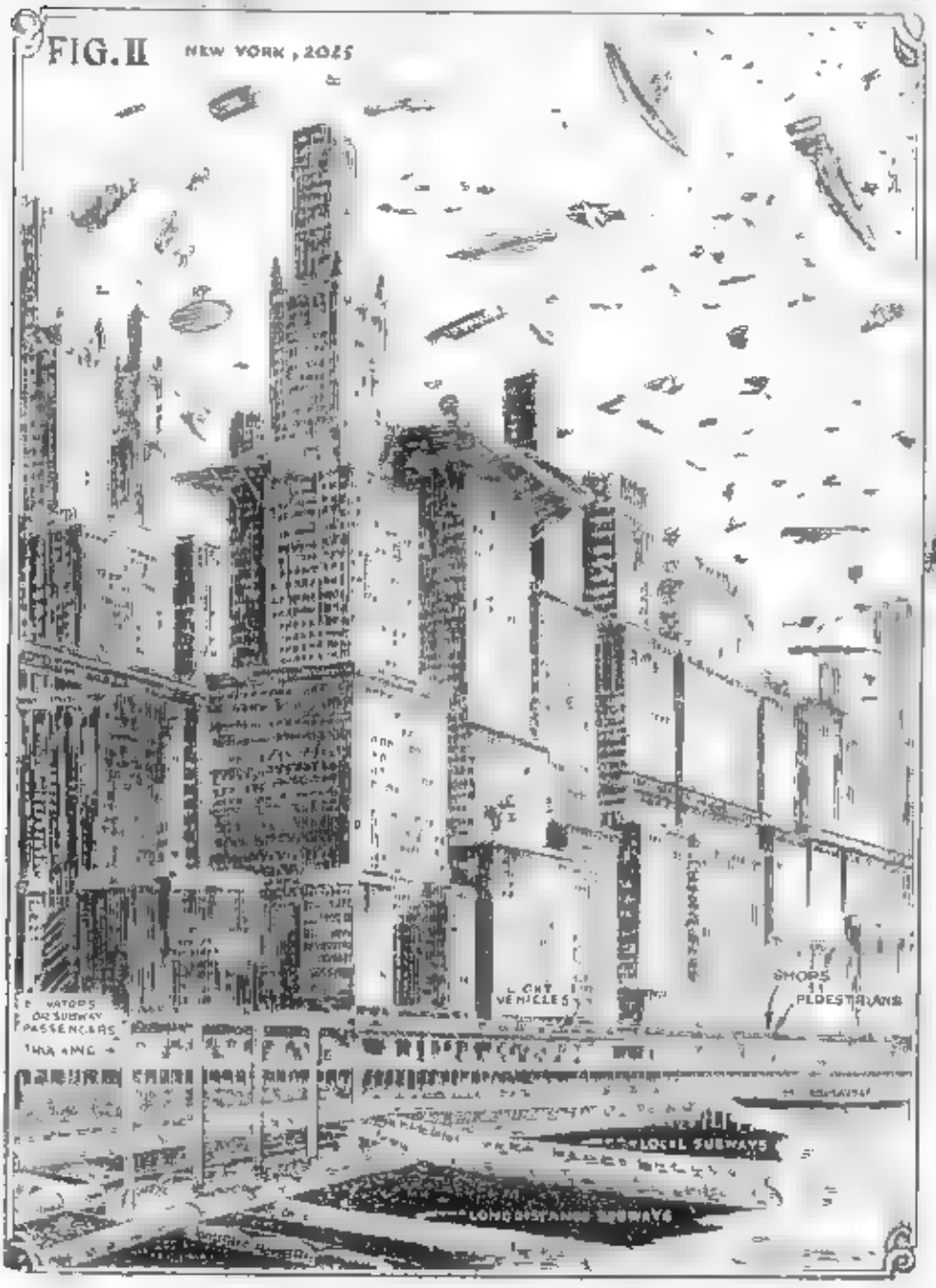



FIG. I NEW YORK, 1800



IN the illustration, Fig. 2, at left, we gain a good idea of the probable appearance of New York's skyscrapers in the year 2025, or a century hence. Other large cities will of course have similar tall buildings without a doubt, as well as numerous underground subways and triple as well as quadruple-decked streets. The lower level of future city streets will be occupied by motor trucks, while the level above this will be occupied by lighter vehicles, such as pleasure cars. The sidewalks, some moving type, in the next twenty-five to fifty years, will doubtless be built above the motor vehicle street level and be arranged inside of arcades within the buildings themselves. This will not only enclose the sidewalks at least overhead, as an insurance against rain and snow, but this arrangement will provide much better show window display facilities for stores. In twenty-five years we of this generation will doubtless see the sky filled with aircraft

# Years Hence

SECOR

A COMMUTER of fifty to one hundred years hence will live in a atmosphere than does the commuter present day. Twenty five miles is abou average distance the commuter o day travels, but fifty years from now the commuting zone for New York business men will have reached out to a fifty mile radius predict such able experts as Thomas N. McCarter President of the Public Service Corporation of New Jersey. This great metropolitan area of half a century hence will each out as far as Trenton N. J. and Stamford, Conn. wide high-speed subways and aerial express routes will carry the commuter to and from his work. Aerial "flivvers" for the fifty-mile commute will be common. Looking at the illustration at the right again we see according to such experts as

have the tremendous pop five to one hundred million people

FIG. III

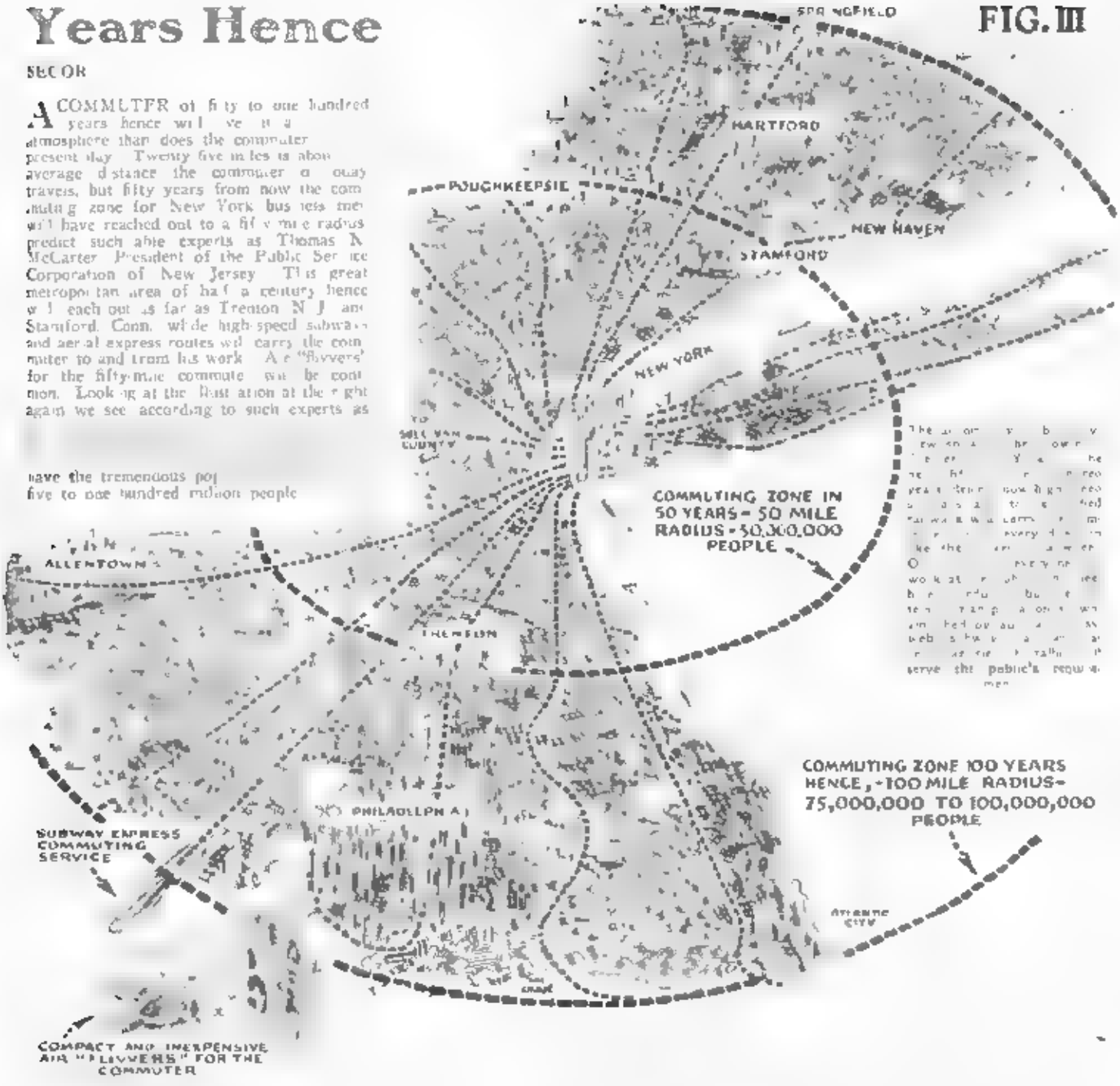
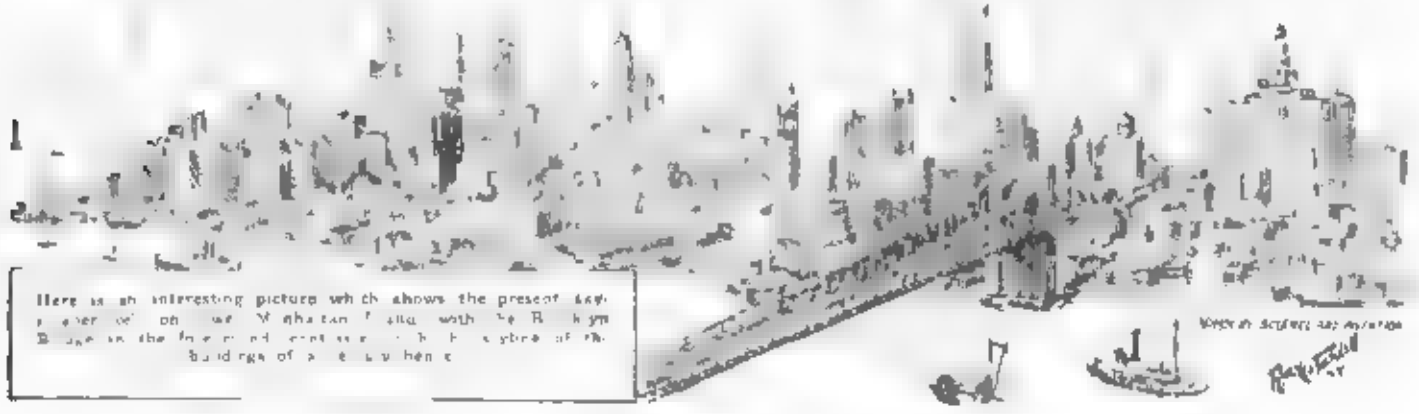



FIG. IV



Here is an interesting picture which shows the present skyline of lower Manhattan Island with the Brooklyn Bridge in the foreground and some of the skyscraper office buildings of a few years hence

# Ice and Water Illumination

By HUGO GERNSBACK

Member American Physical Society

THIS week presents a novel scheme of under ice and under water illumination. There are of course outdoor skating and now of existence of which lighting is provided by means of overhead electric lamps. The writer proposes a novel and very effective by having the ice by means of electric lamps suspended in the water in the manner shown in the small illustration. Each lamp has a glass protector, and the lamp is kept in place by means of an anchor. The glass protector also acts as a sort of heat insulator between the lamp and the ice to keep it from melting. The lamps are about two inches below the surface of the water before the water freezes. Once the water freezes surrounding the electric lamp, and when turned on it provides a weird and fascinating spectacle.

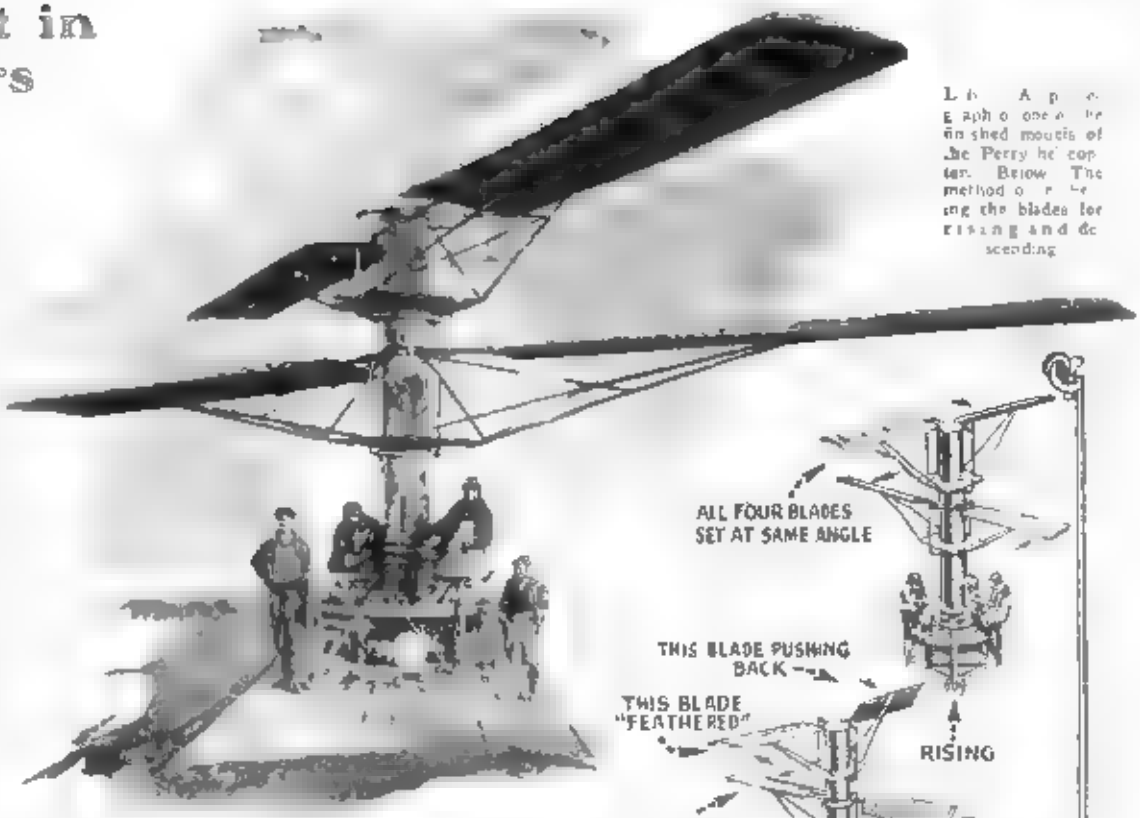
IN this view we see how a large steamer is guided by means of an under water system of the same class as the one used for the ice illumination described above. Channels, inlets, and other dangerously shallow bodies of water can be marked by means of such electric lighting systems which will guide the large steamer so that during the winter months it becomes almost an impossibility.

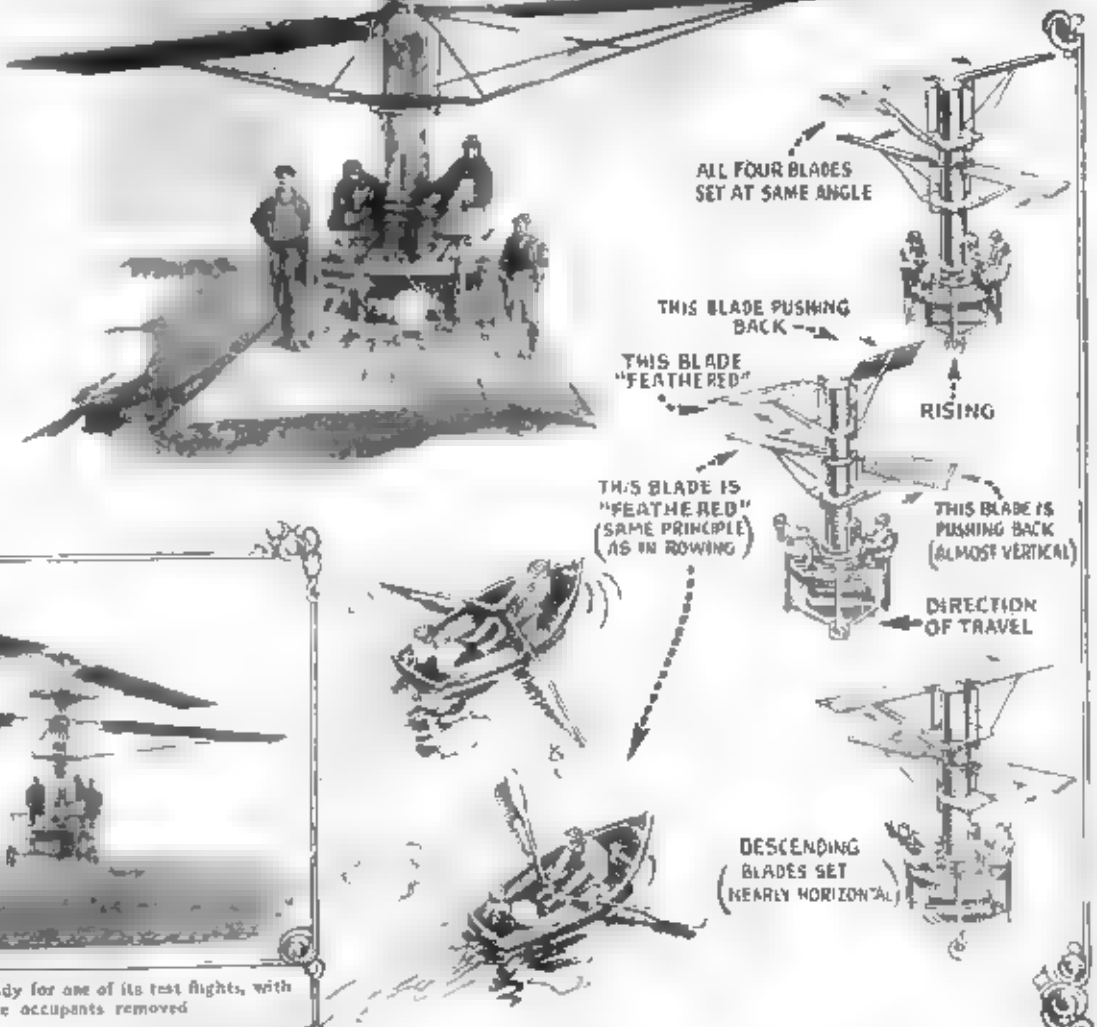
HERE we have a similar scheme to the one described above, with the exception that here a small lake is partly illuminated at night. It should be noted that by means of an illumination of this kind at night not only the pond itself above the lamps is illuminated, but also the surrounding water becomes partly illuminated due to diffusion of the light through the water and the glass globes. It will of course be seen that very effective and beautiful scenes will be produced. The outdoor lighting systems of this kind as well as others illustrated are only mentioned as being good uses to which the present available today. The above forms the subject of a patent application.

# The Latest in Helicopters

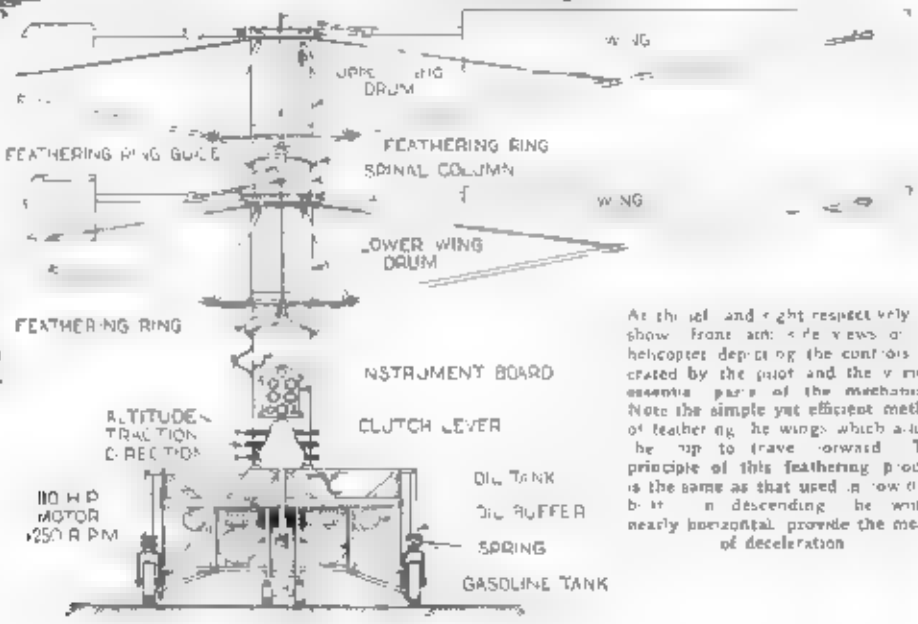
ALTHOUGH helicopters have been considered to be rather out of the question in the field of practical aeronautics up to the present time there have been many experimental models of such devices built. The most notable and one of the latest of these is the Perry helicopter designed by Thomas O. Perry, backed by Chicago Helicopters, Ltd., for entry in the British World-Wide Helicopter Competition and illustrated here. In essence the device may be described as follows. A one hundred and ten horse-power rotary engine drives two sets of wing panels or aerofoils, each four feet wide by eighteen feet long. The ship is sixteen feet high and weighs about 2,200 pounds without fuel, oil or crew. Controls are so arranged and designed that the angles or tilt of the wings can be controlled equally or when desired each wing can be controlled individually. Automatic arrangements allow the blades, when it is necessary, to be "feathered" as illustrated.

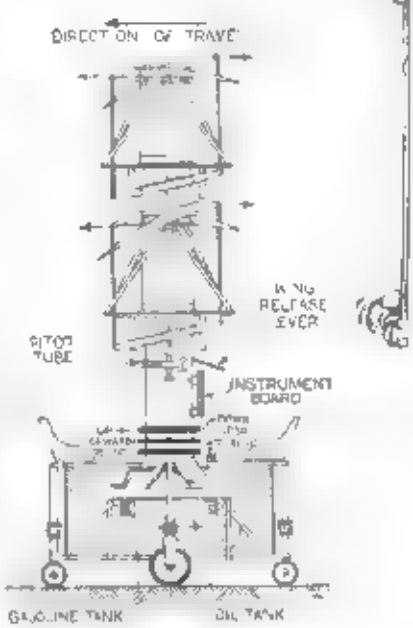
Left: A photograph of one of the finished models of the Perry helicopter. Below: The method of feathering the blades for rising and descending





Above: The Perry helicopter ready for one of its test flights, with the cabin around the occupants removed




At the left and right respectively are shown front and side views of the helicopter depicting the controls operated by the pilot and the various essential parts of the mechanism. Note the simple yet efficient method of feathering the wings which allows the ship to travel forward. The principle of this feathering process is the same as that used in rowing a boat in descending the wings nearly horizontal provide the means of deceleration

# Bringing Down a Zeppelin

During the World War Zeppelin raids on England were a nightly affair. The illustration above was made by an eye witness of the bringing down of a Zeppelin at Potters Bar near London. The Zeppelin was at a great height, and all pursuit planes were sent up. The gunner plane seated flying and a pilot named Robertson dropped a bomb on the huge ship. With a roar the Zeppelin burst into flames and fell. The force of the explosion turned Robertson's plane completely over but he righted it and descended in safety. The entire German crew was killed.—From a sketch by the author

# Roman Perfume Lamps

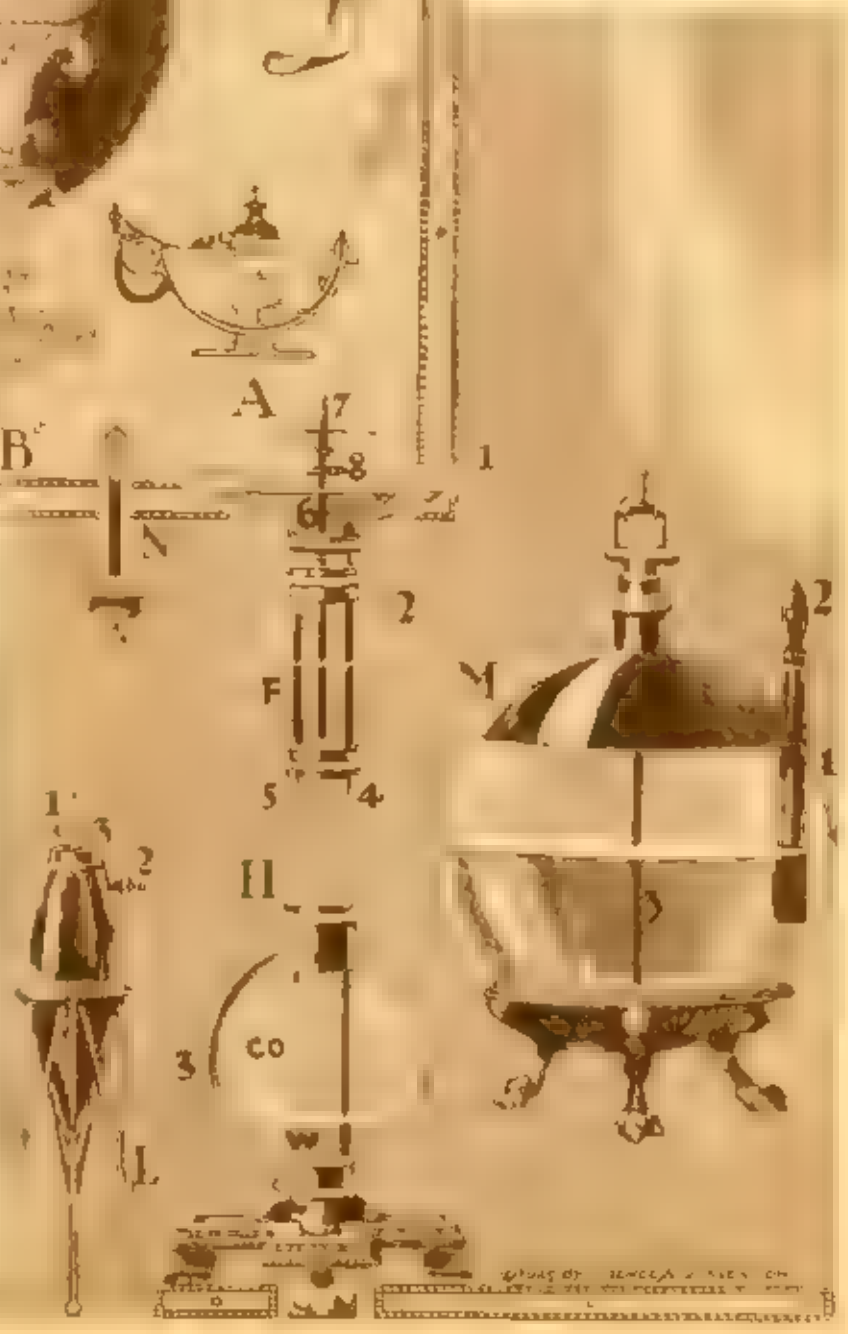
By CHARLES BEECHER BUNNELL

Illustrations by the author.

IN the lives of the ancient Romans perfume played a large part. In fact Nero the Tyrant used it all over his body and clothes even including his shoes. He put perfume on his wines and had it freely distributed over carpets and furniture. The people of his time used various distributing means. Some of them are illustrated on this page. Scented lights were in general use, two of them being illustrated at the left and right of Fig. 1. The latter is an odeon incense box. Fig. D is a Lekythos or incense bottle for the dead, while S is a society perfume bottle and G a perfume oil can also used for massaging. F is a gas producer. Water 1 falls through 2 into 3, forms compression which is transmitted through 5 to 6 in compartment 7 forcing oil through 8 where it exudes at 9 and is vaporized by a gas flame.

THE illustration B shows a combination candelabra, stand and lamp holder. Scented candles were used in this device. A illustrates an automatic self feeding wick in which 1 is a float which engages cog 2 which, as the oil level sinks, actuates 3 and forces wick 4 up as the oil level sinks. This was used by Nero. N is an exuder used with an "Alabastrum" T which contains the perfume. Nozzle of T rests on silk surface and will keep a room perfectly scented for months.

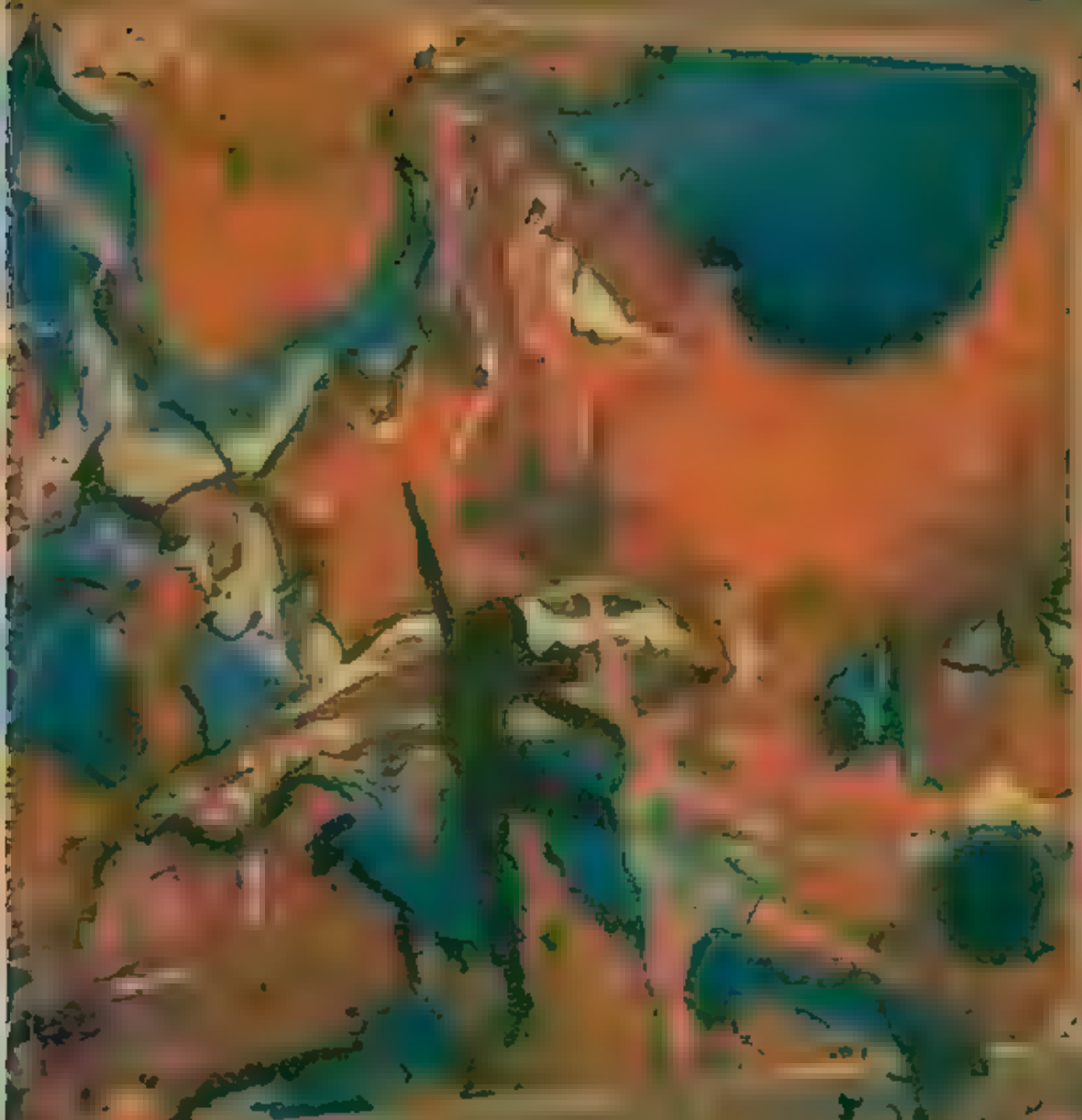
The other three devices are for vaporizing liquid perfume. L utilizes lung compression. In operation, valve 2 is blown into with the mouth and then closed. Opening valve 3, atomized perfume rushes out jet 1. H is a hydro-pneumatic vaporizer. Water poured in 1 flows through 4 into 3, forcing air through 5 into 2 where pressure forces perfume F through 6 out of jet 7 whenever valve 8 is opened. M is a mechanical pneumatic dispenser. 1 is half filled with perfume. Pump 2 is operated by hand, compressing air in space above perfume. This pressure forces perfume through tube 3 out of the jet in the universal joint at the top. The jet can be depressed to a 45-degree angle, allowing perfume to be thrown in all directions. Depressing jet to 90 degrees stops flow.



# Science and Invention

IN PICTURES

THE BATTLE OF THE COLORS



RADIO ARTICLES

# Hotel for Bachelors

By L. SCHUMACHER

Above: The layout of the roof on this newly designed hotel for single men and women. An open air gymnasium and swimming pool are provided. Note skylights for studios.

STUDIO NORTH SKYLIGHTS

An interior view of proposed bachelor apartments as may be seen on this page and gives a very good idea of the compact yet dignified arrangement of the furniture and various appointments. A large well lighted reception hall is provided on every floor. Each space consists of a room ten feet square into which a recess is built every convenience that a person living alone could desire. At one end of the room is found a wardrobe, a complete kitchenette occupying a space only 2' x 3', a lavatory 2' x 2' and a shower bath 2' x 3'. The floor of the latter is tiled and sloped towards the wall where an outlet pipe is provided for allowing the water to run off. The wash basin is hinged so that it may be swung over the toilet and drained. A complete ventilation system is installed, so that the walls and the kitchenette are so arranged that vapors arising in bedroom are removed through the ventilator. Plumbing costs are reduced by installing the equipment for adjoining rooms (above the same wall).

COLLAPSIBLE BED, DRESSER TYPE WITH SLIDING TRAYS AND TYPEWRITER ETC.

COLLAPSIBLE BED, TABLE TYPE

PLUMBING COST CUT TO MINIMUM BY SETTING EQUIPMENT IN PAIRS

SUCTION VENTILATOR DRAWING VAPOR AND AIR FROM BATH, WASH ROOM AND KITCHENETTE

CURTAINS

SHOWER

BASIN AND TAP SWING ON HINGE

CUPBOARD

KITCHENETTE

TRUNK SPACE

WASH ROOM TOILET FLUSHED BY OPENING BASIN STOPPER

The bed, dresser and desk are all combined in this one room apartment and the details of the same may be seen in the insert at the left above. The methods of folding this combination are all indicated. The various articles of furniture in this home may be made either of wood or of enameled pressed steel in various attractive effects.

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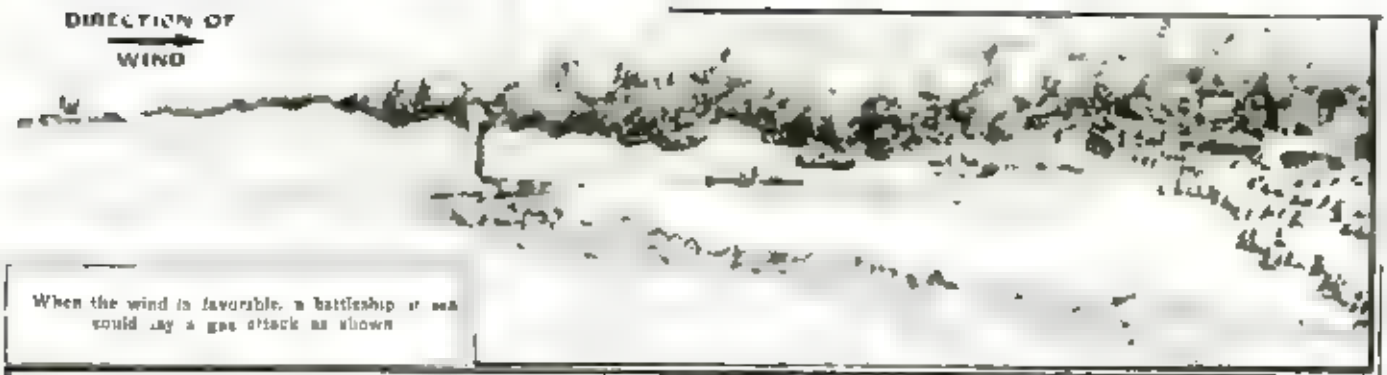
# Can We Fight

**Brig. Gen. William Mitchell, Army Air Service, says he pleas under an**

By H. WINFIELD

FIG.1




When the wind is favorable, a battleship or sea could lay a gas attack as shown

FIG.2

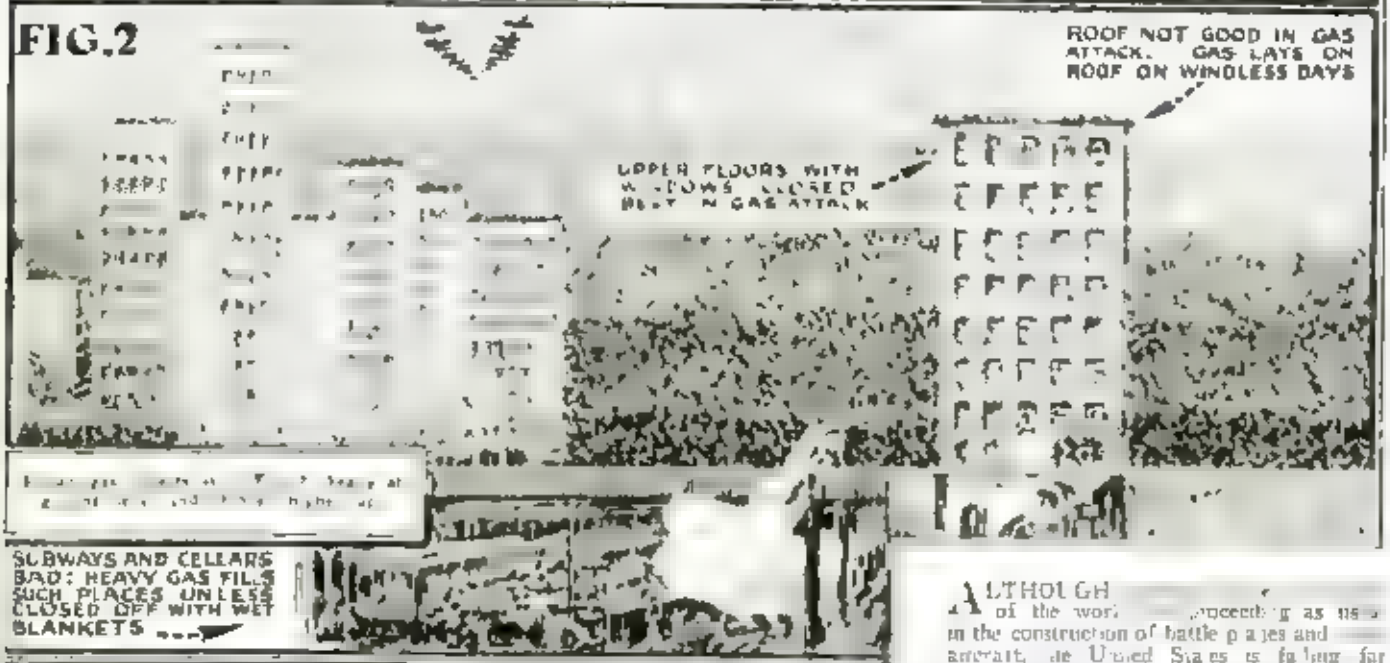
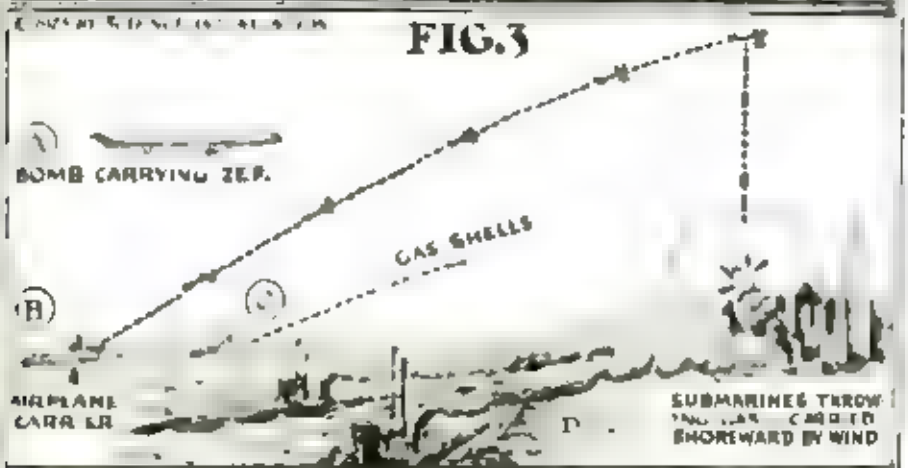



FIG.3




Various agencies could be used by enemy powers for attacking United States cities with gas. These are shown above and consist of airplanes and Zeppelins carrying gas-bombs

ALTHOUGH of the world proceeding as usual in the construction of battle planes and aircraft, the United States is falling far behind. According to Brig. General William Mitchell, New York the United States and seaport is defenseless are. Only by plane the United States today are fit to he Gen use of the be responsible for ordering any one of these planes for active ba se service. He furthermore states that commercial aviation in the United States is practically at a standstill, whereas in other countries that branch of aerial navigation is progressing with leaps and bounds.

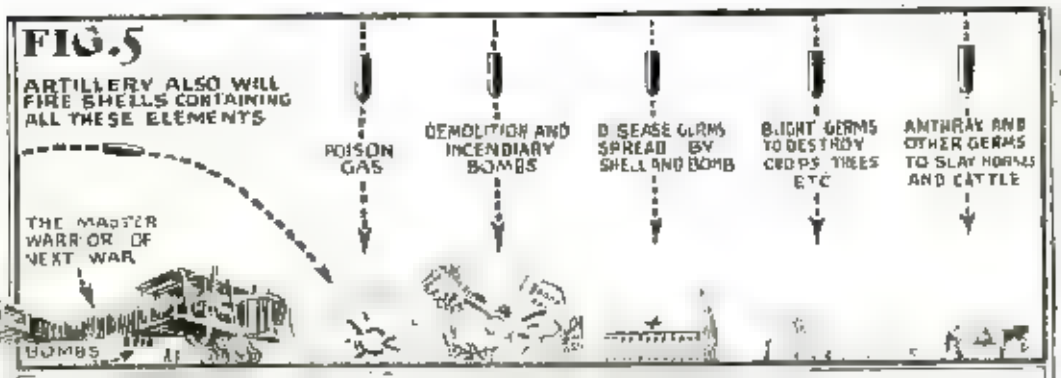
In the particular case of New York City a fleet of large battle planes could quickly annihilate every living being. As shown in Fig. 2, gas could be spread over the entire city by any of the methods indicated in Fig. 3. The gas would settle in the cellars and subways and would penetrate every building. Every line of transportation would be completely tied up, and as New York City is entirely surrounded by water, the millions of inhabitants could not leave the city quickly enough to prevent enormous loss of life. Our aerial defense needs stimulating.

# War Gas Attacks?

**Assistant Chief of the that we would be aerial gas attack.**

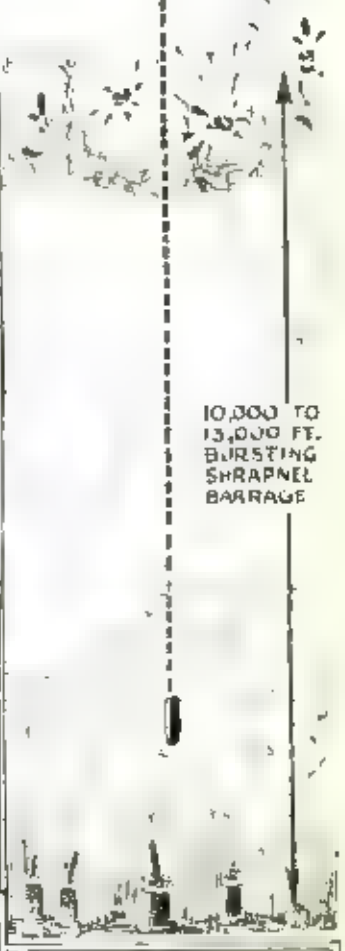
SECOR

FIG.4



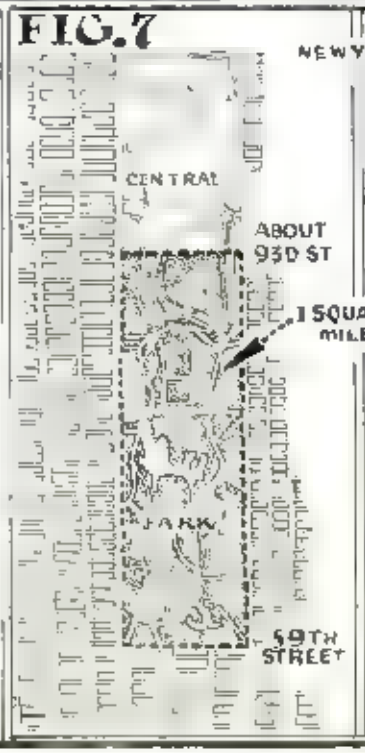

Undoubtedly the master warriors of the next war will be giant aerial bombers capable of carrying several tons of gas bombs and other death-dealing projectiles. Various types of these shells and their purpose are illustrated in the above drawing, Fig. 5. Even the animals will not be spared in the next war. They will be given special attention in the form of germ bombs.

In the event of a poison gas attack, an open plain is the safest place. The wind diffuses and weakens the gas as in Fig. 8. Giant bombers of the future will wreak havoc on cities from a height of 20,000 feet, far above the present range of anti-aircraft guns as shown in Fig. 4.

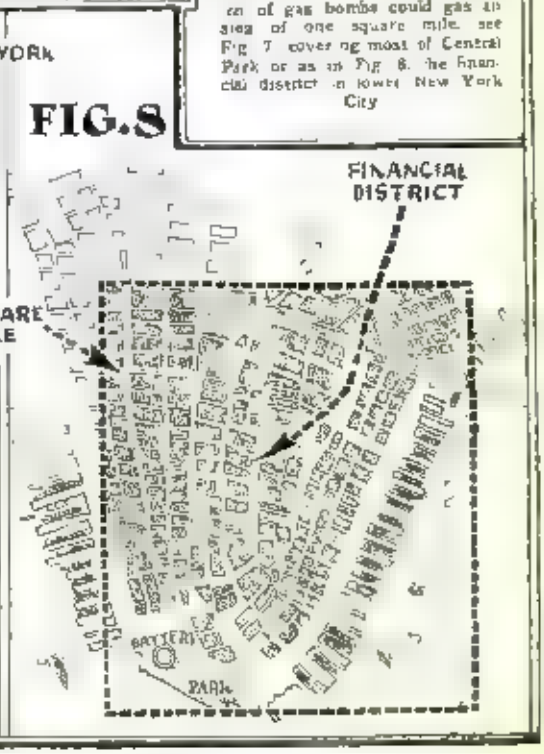



UNDOUBTEDLY the next war is going [illegible] foreign powers have [illegible] record of past made and are still making far reaching [illegible] various types of poison gases. Just [illegible] one large gas attack as at least two hundred and five [illegible] would annihilate service and possibly our thousand eight hundred other planes in reserve. Consider this with our nineteen bombing planes and our very few serviceable observation planes. Suppose that the above-mentioned foreign power were to declare war on us and establish a base on [illegible] coast. Two thousand of their planes, each carrying a quarter of a ton of gas, could [illegible] tons of death-dealing material. Such a fleet of planes could wipe out many of the large cities of this country in record time. And the tragic part of this whole story is that the inhabitants of a city would probably have no knowledge that an attack was being made until they felt the effects of the gas. This would be particularly true in the case of gas bombs dropped outside of city limits, so that the clouds of poisonous material shall be blown toward the habitations by wind.

The effectiveness of gases is increased by the fact that they lie on the ground and penetrate cellars, subways and coal mines.




Thirty planes, each carrying one ton of gas bombs could gas an area of one square mile, see Fig. 7 covering most of Central Park or as in Fig. 8, the financial district in lower New York City.



# Will There Be

By DR GENE
PROFESSOR OF

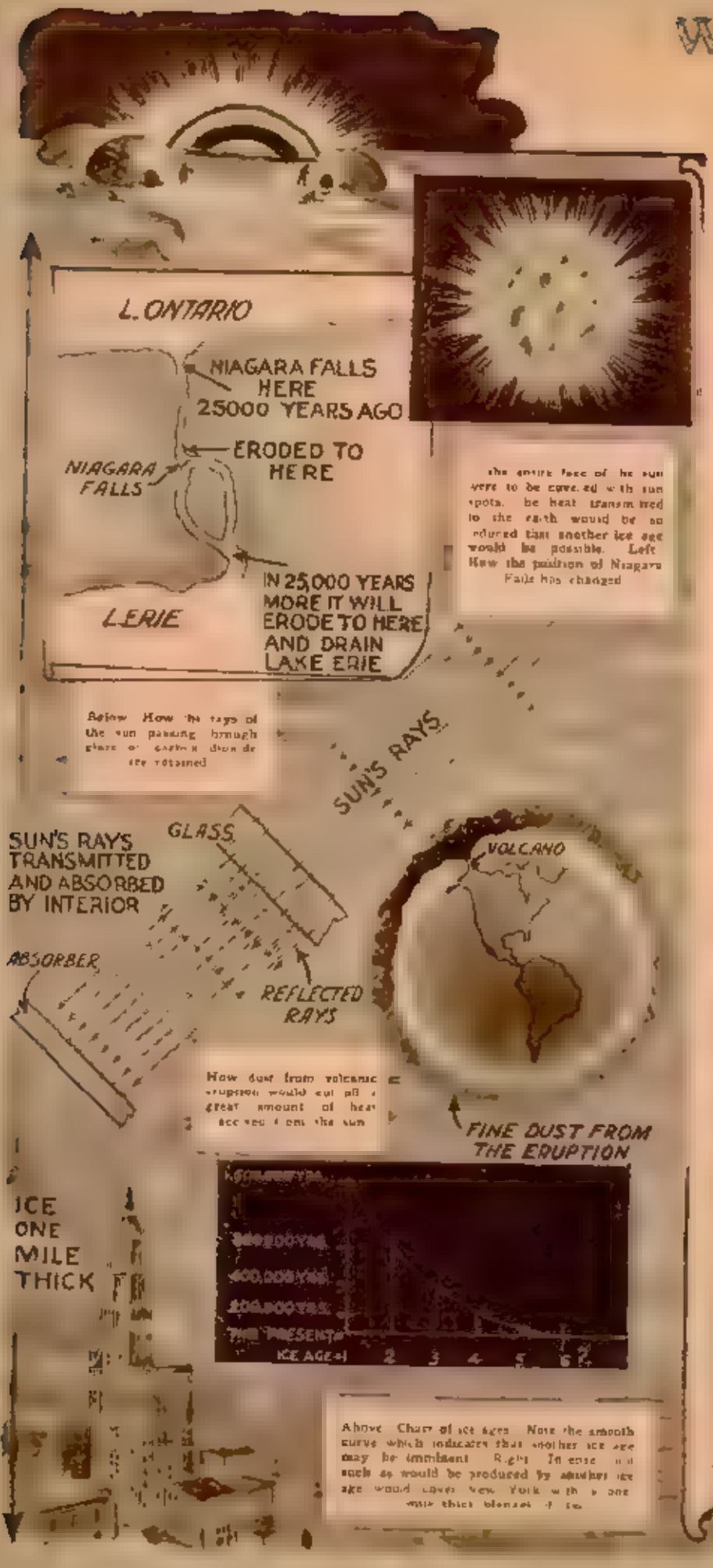
THE recent return of Dr Donald B MacMillan, the well known arctic explorer who reports that the depth of ice in Greenland is increasing, brings up the question of whether or not we shall have another ice age

Geology records that the most recent history of the earth's ice sheet has crept down from the North Pole and covered the North American Continent. The dates of these can only be fixed approximately [illegible] years ago, followed by others at intervals which were halved at each recurrence—800,000, 400,000, 200,000 and 100,000 years. It appears that the next age of glaciation should take place about 50,000 years after the last

When the last sheet of ice that overspread the American continent was retreating, it left a new path for the water from the Great Lakes or Lake Erie to flow to the St. Lawrence. That path lay along what is known as the Niagara River. Now when this river started flowing it had a fall [illegible] Lake Ontario. Since that time it has been eroding back towards Lake Erie. Since it started the falls have not been [illegible] but have been receding backward. If we can average backward erosion per year and divide it into the distance between this point and the present location of the falls, we can obtain the time which has elapsed since the ice sheet was on that spot. The actual erosion took probably 25,000 years but to this must be added 5,000 to 9,000 years for the period during which the ice was melting before it reached the Niagara River and enabled it to start running. The total time, therefore, since the last age is from 30,000 to 35,000 years. It appears that another ice age may be due in a very short time, geologically speaking. However there is at the present time no need for the general public to become alarmed at this prospect. Such a phenomenon will probably not occur within the lifetime of the present generation or even of several generations to follow. Time expressed in geographical terms as being short usually means a thousand years or more. In the life history of this little earth of ours, a mere thousand years is but as a minute in the lifetime of a human being.

The causes of the ice ages are very obscure. It has been suggested that our sun may occasionally become almost covered with the spots which are often visible upon its surface. This would so reduce the amount of heat radiated that ice would immediately form on the earth.

Another explanation may be found in the possible change in the composition of our atmosphere. The temperature inside a greenhouse may be quite comfortable even when it is freezing without. The glass allows the [illegible] to enter, but will not allow the [illegible] to escape. [illegible] outside [illegible] water vapor [illegible] our atmosphere acts [illegible] a glass house. It [illegible] for some reason or other [illegible] were almost entirely removed, a great deal more heat would escape than [illegible] and the effect [illegible] ice ages [illegible] A diagram showing how glass stops the heat rays through glass is given at the left. The rays first pass through the glass and are then partially absorbed and partially reflected by the interior. These reflected rays are again turned back by the glass and a great amount of heat results



# Another Ice [illegible]

## DEACTIEM

ASTRONOMY

[illegible]

A change of [illegible]

[illegible]

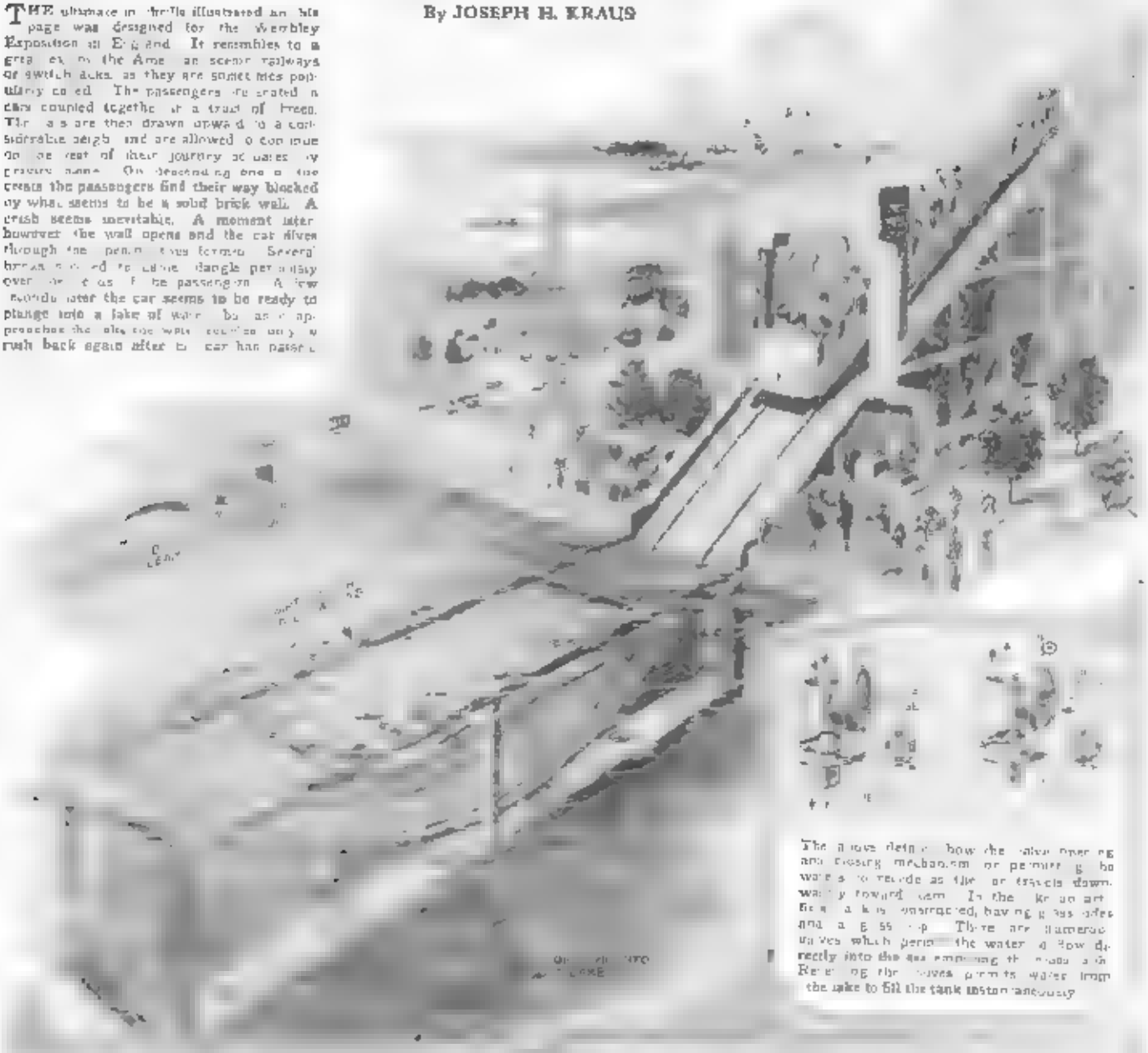
# Science and Invention

www.americanradiohistory.com

# Dashing Through Brick Wall, King of Thrillers

By JOSEPH H. KRAUS

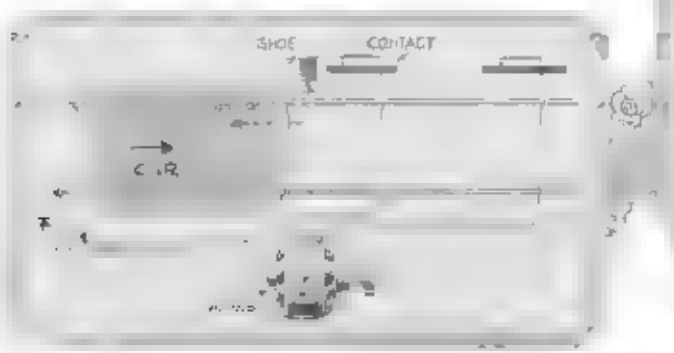
THE ultimate in thrills illustrated on this page was designed for the Wembley Exposition at England. It resembles to a great extent the American scenic railways or switchbacks, as they are sometimes popularly called. The passengers are seated in cars coupled together in a train of three. The cars are then drawn upward to a considerable height and are allowed to continue on the rest of their journey at varying pressure speeds. On descending one of the crests the passengers find their way blocked by what seems to be a solid brick wall. A crash seems inevitable. A moment later however the wall opens and the car dives through the opening formed. Several breakaways are provided to allow danger personally over the crests. For the passengers. A few seconds later the car seems to be ready to plunge into a lake of water but as it approaches the lake the water recedes only to rush back again after the car has passed.

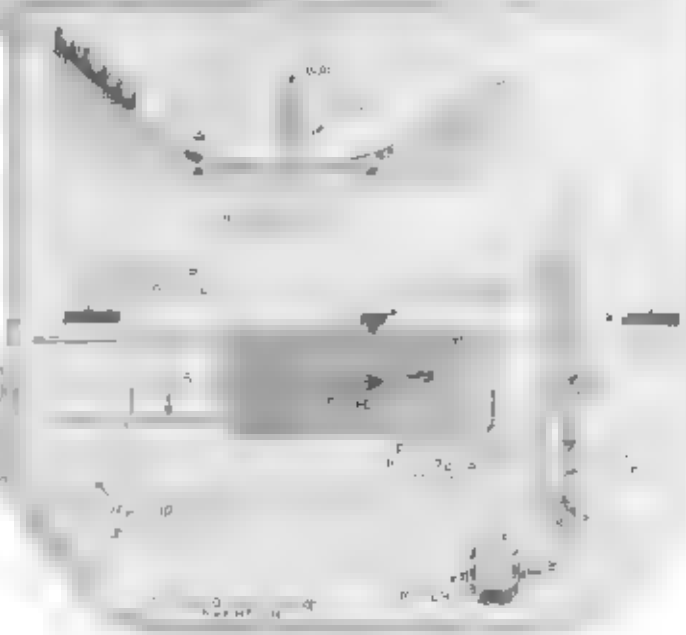


The above diagram shows the valve operating and closing mechanism for permitting the water to recede as the car travels downward toward them. In the ground are placed a long underground, having grass edges and a grass top. There are numerous valves which permit the water to flow directly into the sea enclosing the roadway. Opening the valves permits water from the lake to fill the tank instantaneously.

The system at the right shows the brick door opening mechanism. As the car travels downward, it closes the circuit to a motor through the agency of a shoe and an extra contact rail. The doors swing open, the brakes are lowered and the doors close again as the car closes the circuit to the motor after it passes through the opening in the wall.

The section below shows a detail section to the motor for operating the gates in the brick wall and similarly the water division.



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It was often said during the recent war that the anti-aircraft guns mounted around cities were so regulated that the shrapnel and shell fragments would fall within a certain deserted area. This has been proven false and it has been shown that in the case of London many casualties resulted when the projectile or shrapnel from the guns protecting the city falling in an occupied section

# Aircraft Bombs Versus Anti-Aircraft Defense

## By MAJOR H. H. ARNOLD, U. S. Army Air Service

DURING the period from the time the Wright Brothers made their first flight until 1910 the airplane was accepted as a possible advance in the army [illegible] having certain unknown possibilities in making reconnaissances, but otherwise it was [illegible] The [illegible] of the world were given [illegible] Francisco, Cal., in 1910, [illegible] borough, home to the thinking people the offensive possibilities of the airplane by dropping the first bomb ever released from an airplane. Although the bomb was dropped [illegible] cal was a decided step [illegible] weapons [illegible]

The plane that he went up in could carry only a few pounds in addition to the pilot and the passenger. It was therefore remarkable that the bomb was dropped at all. The bomb weighed only about ten pounds, was made of cast iron and had a long stick inserted in its tail to keep it in a straight line of flight.

### FIRST AIRPLANE BOMBING

No further developments were made until the Italians landed an expedition, in 1912, at Tripoli for operations against the Turks. The troops making up this expedition were accompanied by two planes but no one, not even the aviators themselves, would venture to predict what value if any the planes would be to the army. These planes made reconnaissance of great value. By their presence alone caused much consternation among the Arabs and dropped bombs whenever they had the opportunity and could get the bombs. In some instances they dropped these bombs upon enemy encampments or masses of troops causing great havoc and many casualties. They used small fragmentation bombs which were dropped by hand but they had no means of determining the proper time to project them from the plane other than the judgement of the bomber. Accordingly they made more misses than hits.

Later in the same year the Bulgarians in their war against the Turks made a rather important development when they

(continued on page 370)

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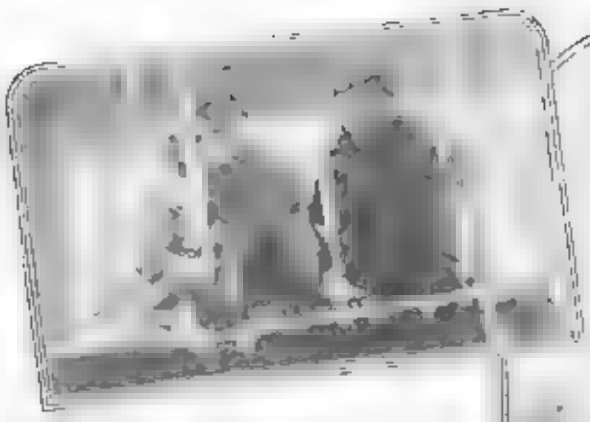
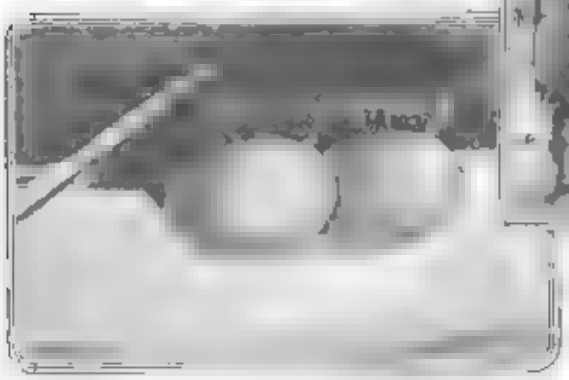
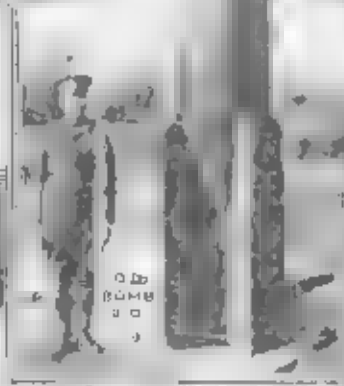


One of the first aerial bombs that was ever used. It weighed 20 pounds and was first dropped from a plane in 1910. The bomb did little damage and was hardly worth the trouble necessary to drop it.

The illustration above shows one of the present day types of bombs carried by airplanes. Compare it with the one shown at the extreme left. The advance in aircraft warfare is obvious.

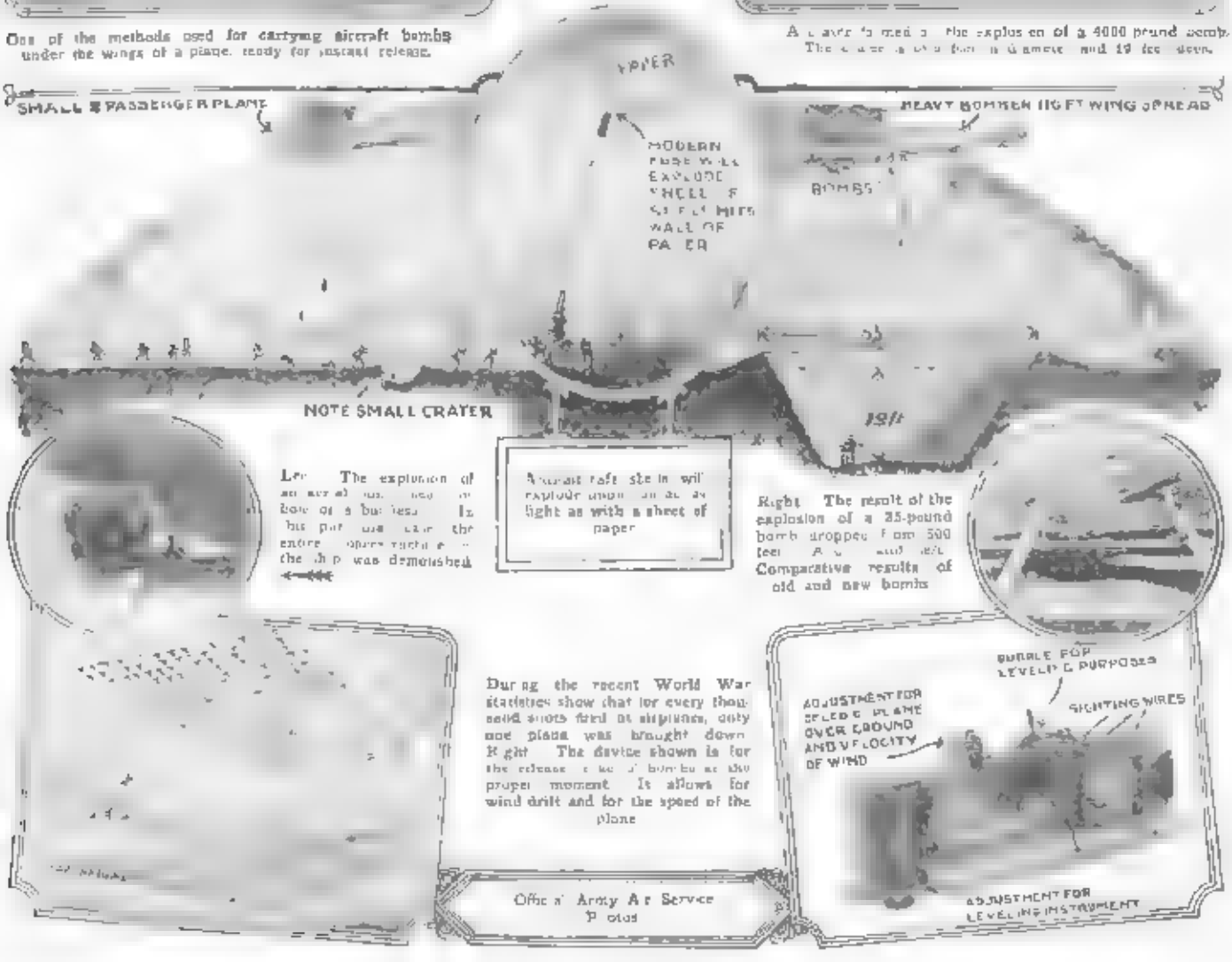


One of the methods used for carrying aircraft bombs under the wings of a plane, ready for instant release.



A 4000-pound aerial bomb compared with a man and with the 10-pound bomb of 1910.

A clever method of showing the explosion of a 4000 pound bomb. The crater is 60 feet from diameter and 19 feet deep.




Left. The explosion of an aerial bomb on the bow of a battleship. It has put one gun out of action, the entire upper structure of the ship was demolished.

Right. The result of the explosion of a 25-pound bomb dropped from 500 feet. A hole and dent. Comparative results of old and new bombs.

During the recent World War statistics show that for every thousand shots fired at airplanes, only one plane was brought down. Right. The device shown is for the release of bombs at the proper moment. It allows for wind drift and for the speed of the plane.

Official Army Air Service Photos

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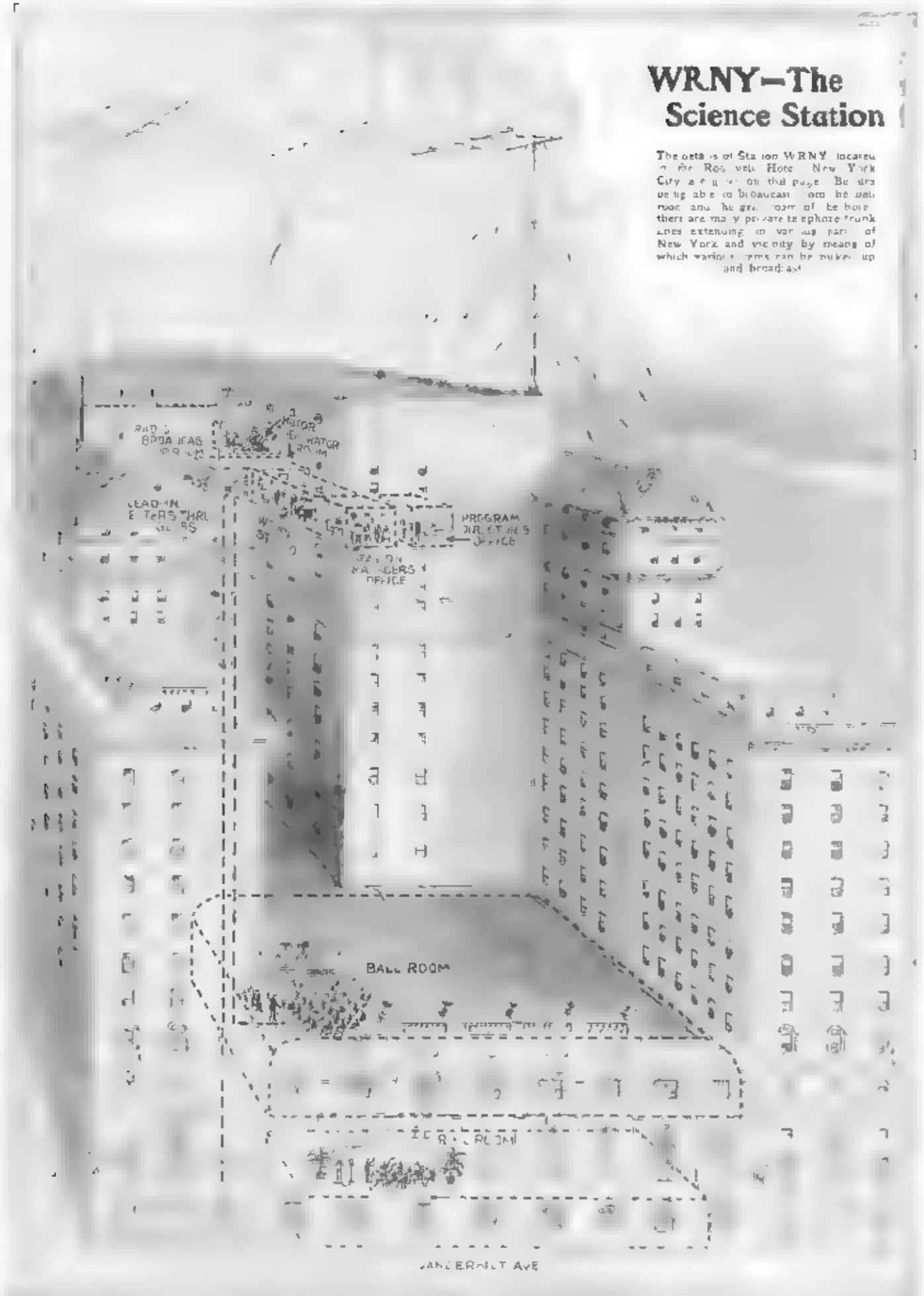
# WRNY—The Science Station

The studios of Station WRNY, located on the Roosevelt Hotel, New York City, are pictured on this page. Besides being able to broadcast from the ballroom and the grand room of the hotel, there are many private telephone trunk lines extending to various parts of New York and vicinity by means of which various items can be picked up and broadcast.




This station is owned and operated by the publishers of this magazine

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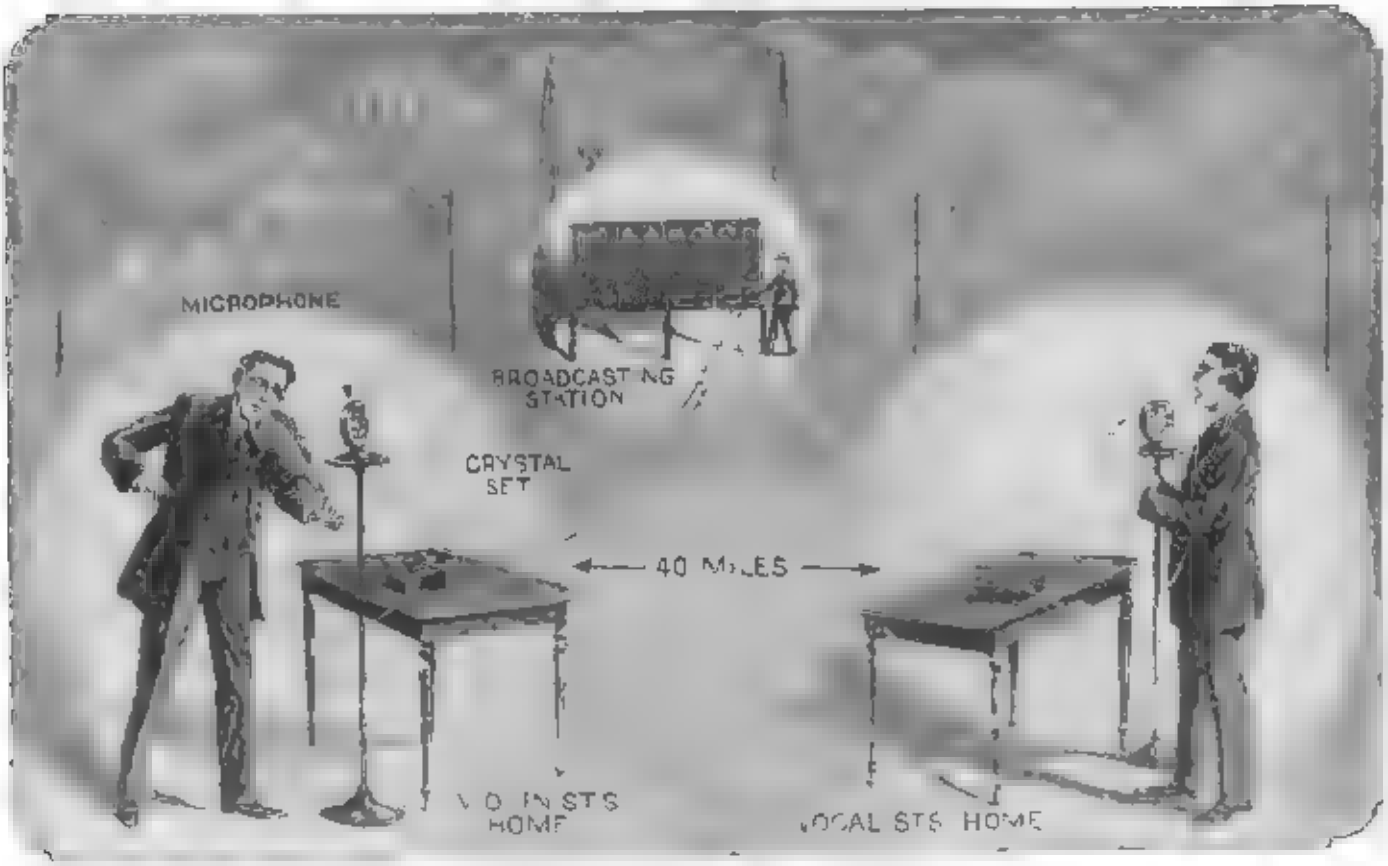
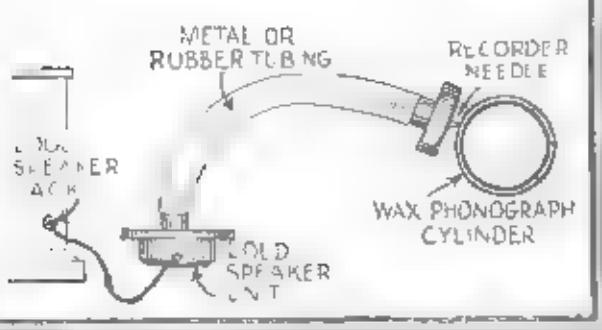
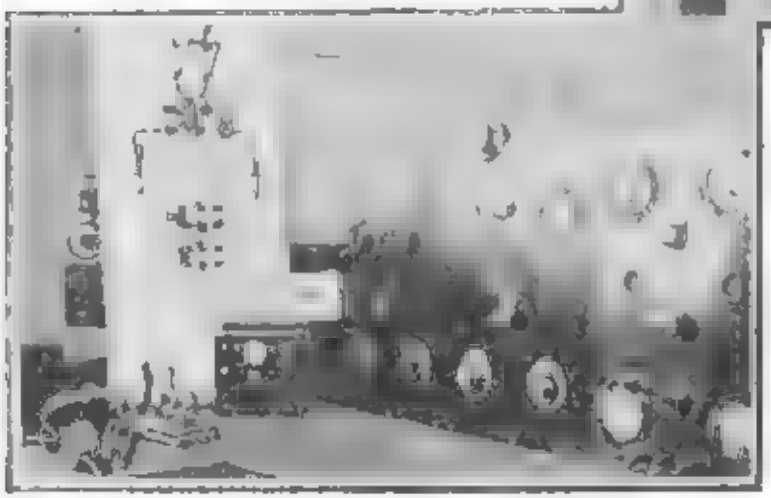
# Artists Forty Miles Apart Broadcast




In a recent novel test, illustrated above, a violinist and a vocalist in their respective homes broadcast in perfect synchronism from a distant station. Their microphones as shown were connected to the broadcasting stations and they listened in on each other and checked their synchronism by means of two small crystal sets with earth connection and antenna as shown. Listeners-in stated that the accompaniment was perfect.

# A New Use For The Radio





A new radio fan wires to broadcasting stations at different points, asking for favorite selections to be played. In accordance with the prearranged programs these requests are soon received. A San Francisco man solved his problem by attaching one of the earphones of his headset to the speaking tube of his stenographer's telephone, with the result that he no longer has to call up the studio of the broadcasting station for his favorite selection to be refused on account of lack of time. The stenographer when it comes over the record on his own record and can be played at any time desired.

The photo to the left shows the radio station of Dave Ablowich, Jr., call 5DW at Greenville, Texas, with which he reached New Zealand 3,500 miles away. We see the marble power panel, a wavemeter, the main panel with the 50-watt transmitter tuned to 78 meters for New Zealand. Next is a 15-watt telegraph set for 17 meters to Australia 3,500 miles. A 10-watt radio phone set for ships and last under the call KFFM.

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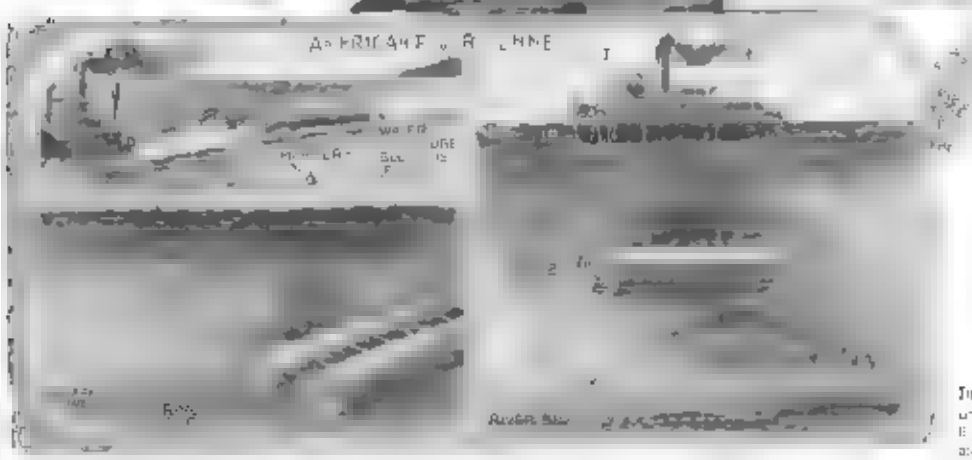
WRNY
STATION
Science and Invention
IN PICTURES
IP
MOVIE

# London to Paris by Rail

## Newly Proposed Sub-aqueous Railway Adapted to Trans-oceanic Requirements

We illustrate herewith a novel system of undersea railroad tunnels recently proposed. This does not mean that the usual bore cut through the earth but the tunnels are supported on piers

Above: Two views of a finished tunnel system of this new type. Inset: How the sections are placed in position. Great caverns, water-tight, they are towed into place and then filled with water. They sink to the piers.




Above is shown one of the American tunnel systems wherein the twin tubes rest on the bottom. Here also the water-tight tube sections are floated to position and sunk. Divers serve to guide the tubes into the desired position after which the abutting ends are sealed together

In the new scheme for building a railroad under the English Channel it is proposed to [illegible] piers as shown above all piers being in accurate alignment. The caissons are built on shore and made water-tight. They are then towed to position and when water is let in they sink. The ends are so shaped as to fit into the piers whereupon the new caisson is sealed to that section of the tunnel already in place

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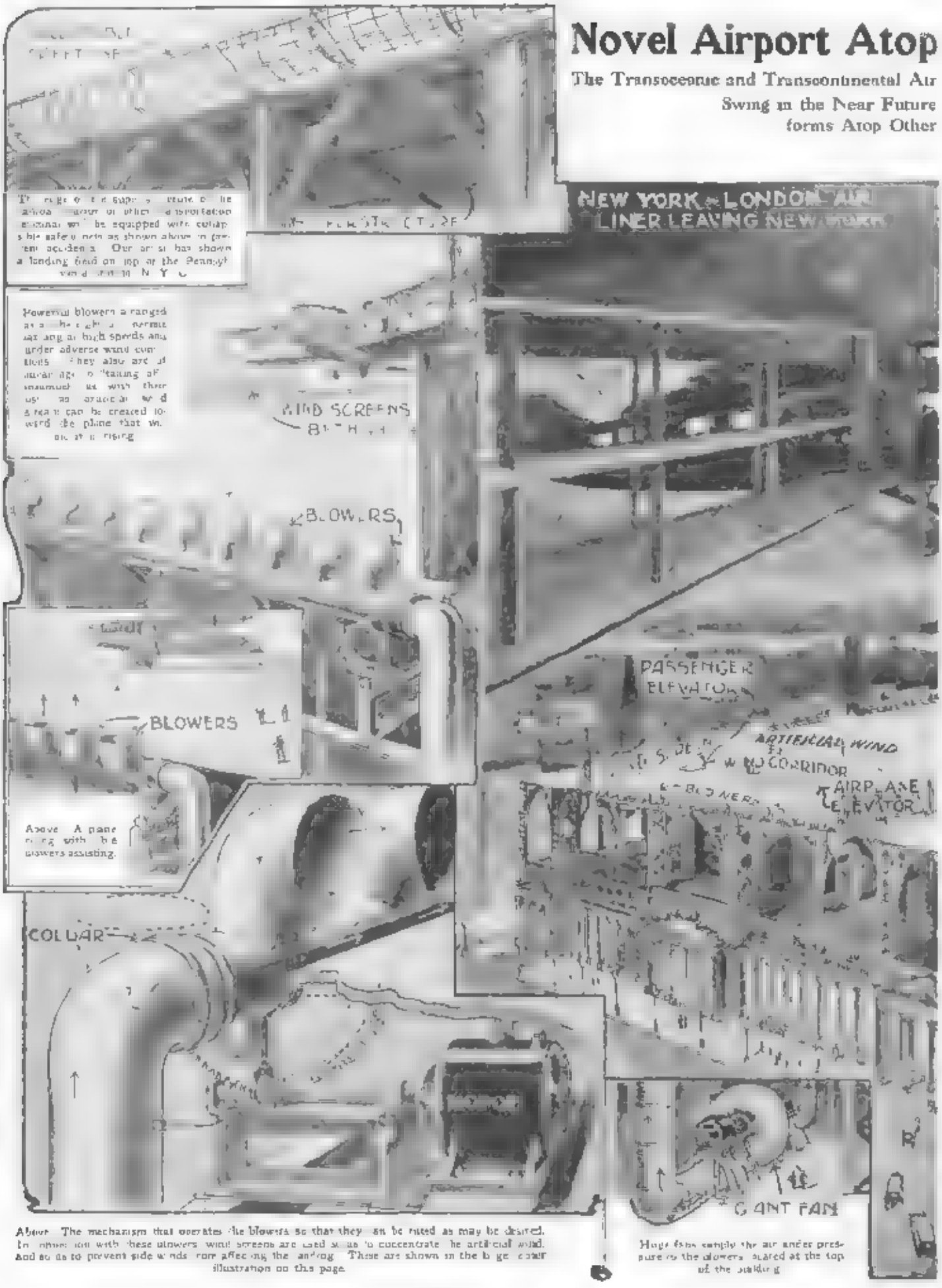
# Novel Airport Atop

## The Transoceanic and Transcontinental Air Swing in the Near Future forms Atop Other




The huge [illegible] supporting structure of the airdrome [illegible] other transportation systems will be equipped with collapsible safety nets as shown above in case of accidents. Our artist has shown a landing field on top of the Pennsylvania [illegible] N. Y. C.

Powerful blowers arranged as shown here permit planes to land at high speeds and under adverse wind conditions. They also are of great advantage in starting of planes as with their use an artificial wind stream can be created toward the plane that will enable it to rise.

Above: A plane rising with the blowers assisting.

Above: The mechanism that operates the blowers so that they can be rotated as may be desired. In connection with these blowers wind screens are used also to concentrate the artificial wind. And so do to prevent side winds from affecting the landing. These are shown in the large center illustration on this page.

Huge fans supply the air under pressure to the blowers located at the top of the building.

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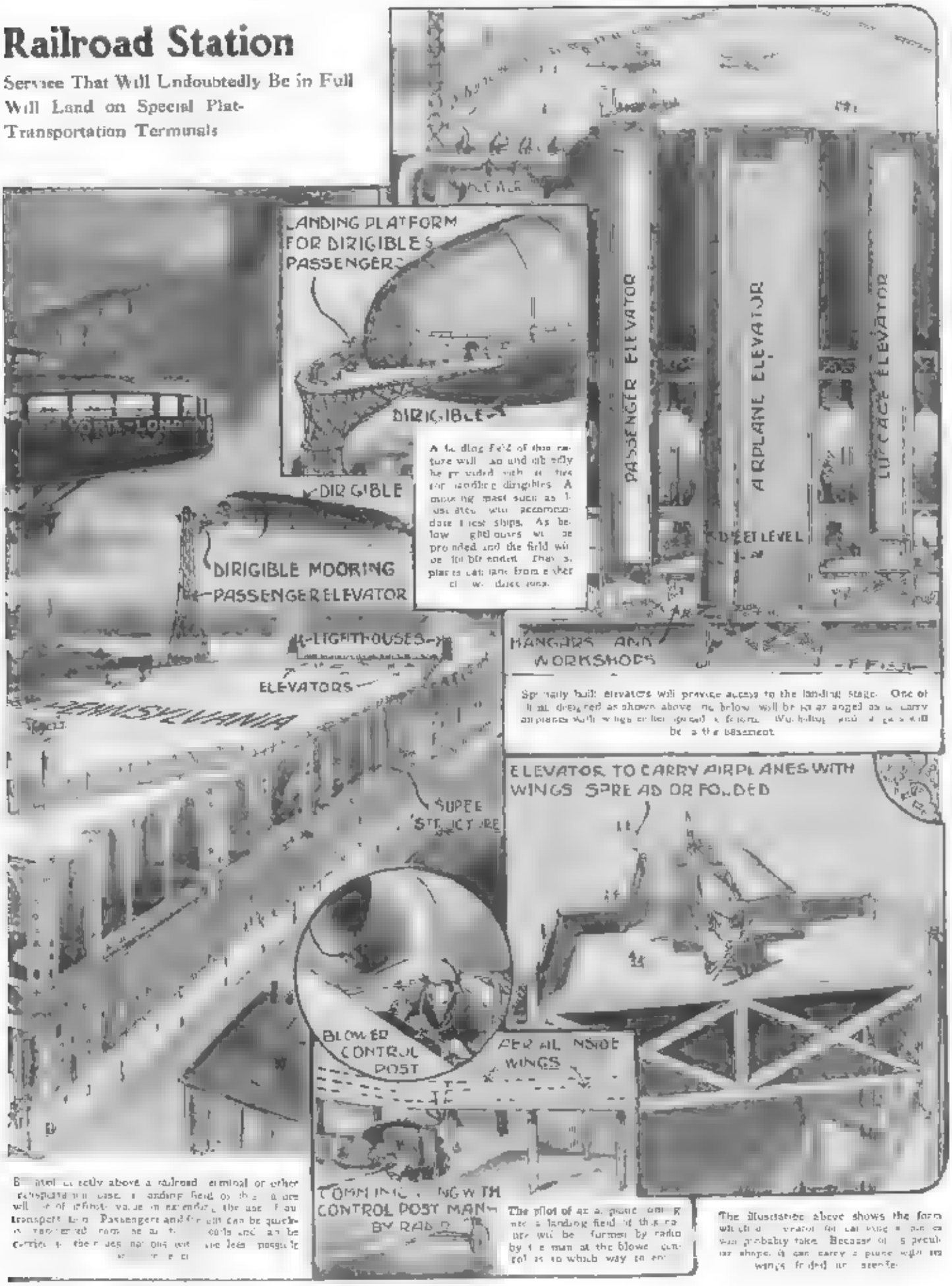
# Railroad Station

**Service That Will Undoubtedly Be in Full Will Land on Special Plat- Transportation Terminals**




A landing field of this nature will not only be provided with facilities for handling dirigibles. A mooring mast such as illustrated will accommodate these ships. As below ground hangars will be provided and the field will be fully protected. There will planes can land from either of two directions.

Specially built elevators will provide access to the landing stage. One of these, designed as shown above, no below, will be large enough to carry airplanes with wings either spread or folded. Workshops and garages will be in the basement.

Built directly above a railroad terminal or other transportation base, a landing field of this nature will be of infinite value in expediting the use of transportation. Passengers and freight can be quickly transferred from air to train, trolley and auto and be carried to the cities nearby without the less pleasant

The pilot of an approaching plane will receive a landing field of this nature will be furnished by radio by the man at the blower control as to which way to en-

The illustration above shows the form which the elevator for carrying planes will probably take. Because of its peculiar shape, it can carry a plane with its wings folded or erected.

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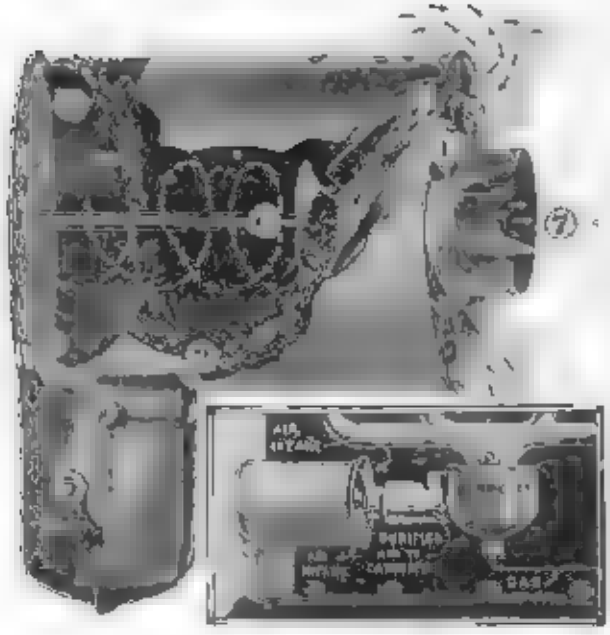
# Boat for Shallow Water

In rivers where boulders and rocks are often encountered, any method of most difficult and frequent dredging of the river bed becomes an absolute necessity. However, the use of boats such as illustrated above would eliminate all trouble. With this boat no propeller is used. On either side of the vessel are placed caterpillar chains resembling somewhat those used on tractors. They are equipped with paddles which allow the boat to crawl over the obstructions in the water. One flexible type of paddle folds up as shown in the upper right-hand corner of the above illustration and provides for the boat over rocks. When in deep water, these paddles serve as propellers. An optional method of construction is also illustrated. In this the paddles are rigidly fastened but they provide propulsion in water and at the same time give traction on the bed of the river without clogging up. Either form of construction would obviously be of great value on some of our inland waterways.

—C. Kurt Valtmin.

## Air Cleaner



An air cleaner for carburetors is illustrated at the left. The dust-laden air enters at 1, is whirled by the stationary blades, which cause the dust-laden air to be thrown against the sides of the container from whence it enters the removable container 5. Clean air is supplied to the carburetor.

## Hunter's Hat

Often duck hunters in rainy weather are severely handicapped because of the fact that the rain blows into their eyes and cannot be kept out by the ordinary cap visor as such a visor obscures vision. A celluloid hat as above illustrates this possibility.

Author please send address.

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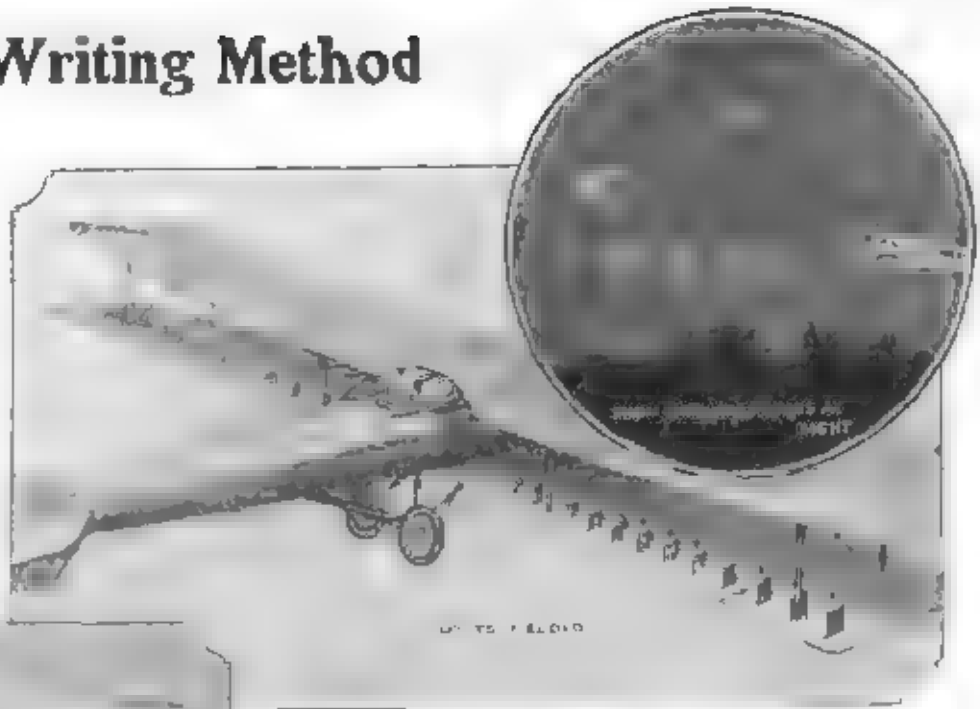
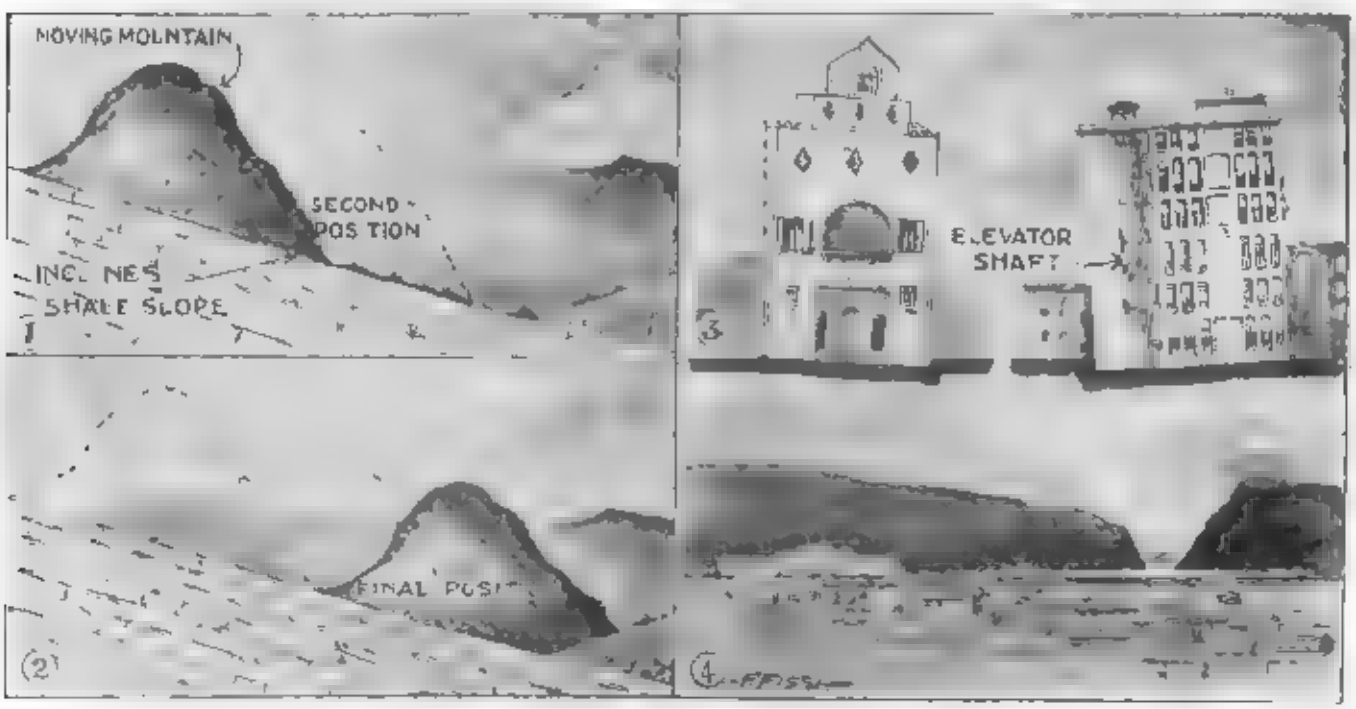
# New Sky Writing Method

A new method of sky writing, radically different from the well known method, is covered by patents issued to R. D. Dalley of England. The system is illustrated herewith. An airplane flying at a height of approximately one mile or more flies group of bombs which, bursting into smoke puff during the day or colored stars at night, are so arranged as to produce dots or numerals as shown in the inserts herewith. The method used is shown in the lower right-hand corner. A combination gun consisting of several barrels arranged as shown ejects bombs equipped with time fuses so that all explode simultaneously. Several units are arranged along the lower wing of a plane as shown at the right. This method is superior to others in that it is cheaper and faster to produce. A skilled pilot is not necessary for the operation.




# Earth's Surface Is Shifting




A curious phenomenon has taken place near Mexico City. Cold. A mountain 2,000 feet high and containing a hundred million tons of dirt and rock moved as shown in Figs. 1 and 2 at a rate of 2 feet an hour for a space of 50 yards. The mountain has moved a total of a quarter of a mile in 2 years. Buildings in Mexico City are gradually sinking as shown in Fig. 3. Tilting to one side they present serious engineering difficulties. In some, elevators cannot run. The city is gradually sinking into Lake Texcoco and in 400 years will probably be below water as in Fig. 4.

—Donald H. Menzel, Ph.D.

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# Science and Invention

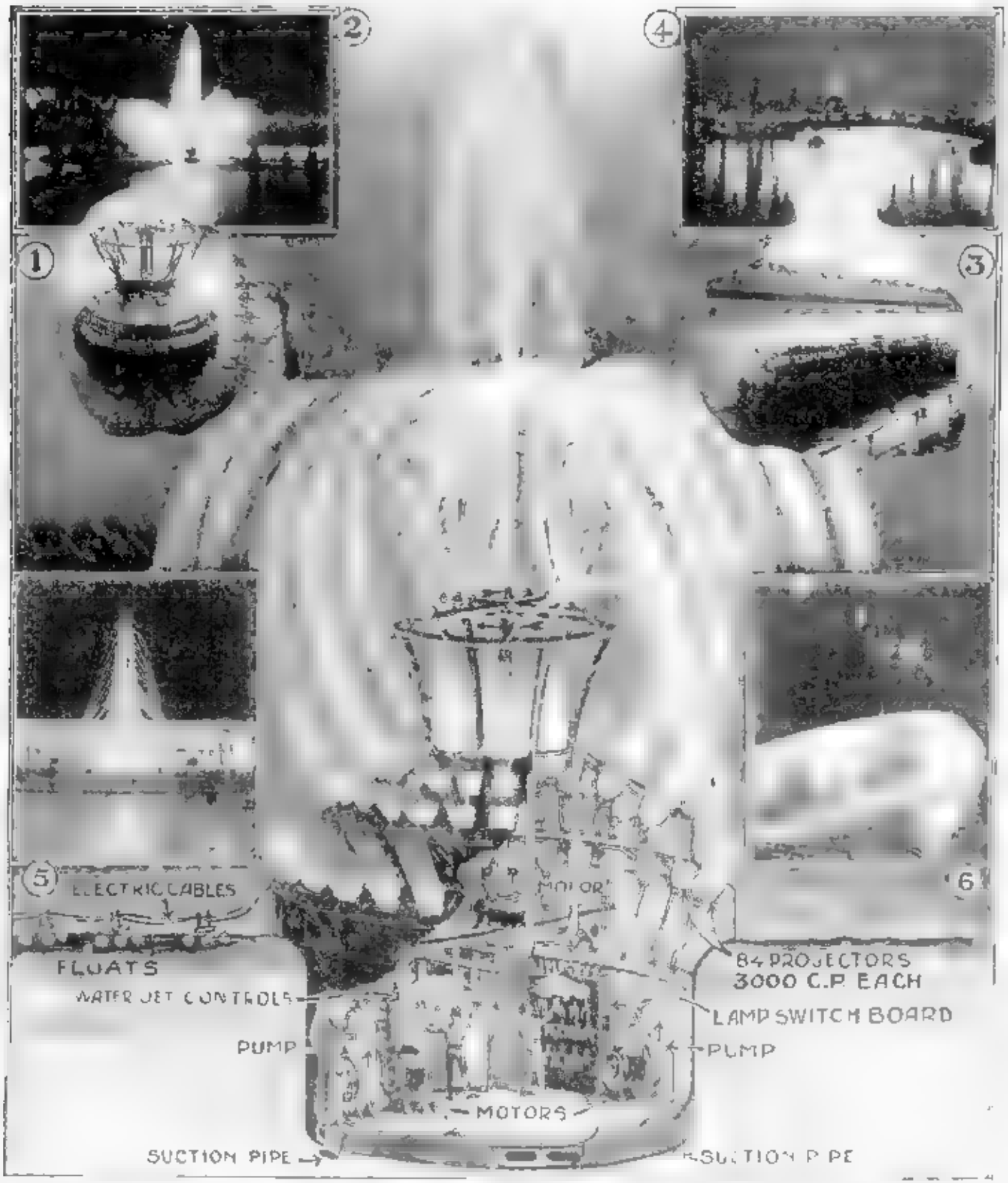
## MATCHCRAFT
### THE NEW CRAZE

See Page 707

EXPERIMENTER PUBLISHING COMPANY, NEW YORK, PUBLISHERS OF
RADIO NEWS ~ SCIENCE & INVENTION ~ THE EXPERIMENTER ~ MOTOR CAMPER & TOURIST

# Electric Fountains Float In the River Seine

By A. N. MIRZAOFF




THE photograph on page [illegible] shows a floating fountain moored to the bank of the Seine [illegible] the Eiffel Tower. The electrically operated water effects are illuminated by powerful searchlights. The picture shows the Eiffel Tower and some of the [illegible] Paris. The [illegible] are [illegible] to [illegible] the [illegible] purposes. Note how some of the [illegible] are [illegible] while keeping [illegible] conditions [illegible] water. Compare [illegible] with [illegible] the [illegible] of the water jets

# Bridge Is Great Engineering Feat

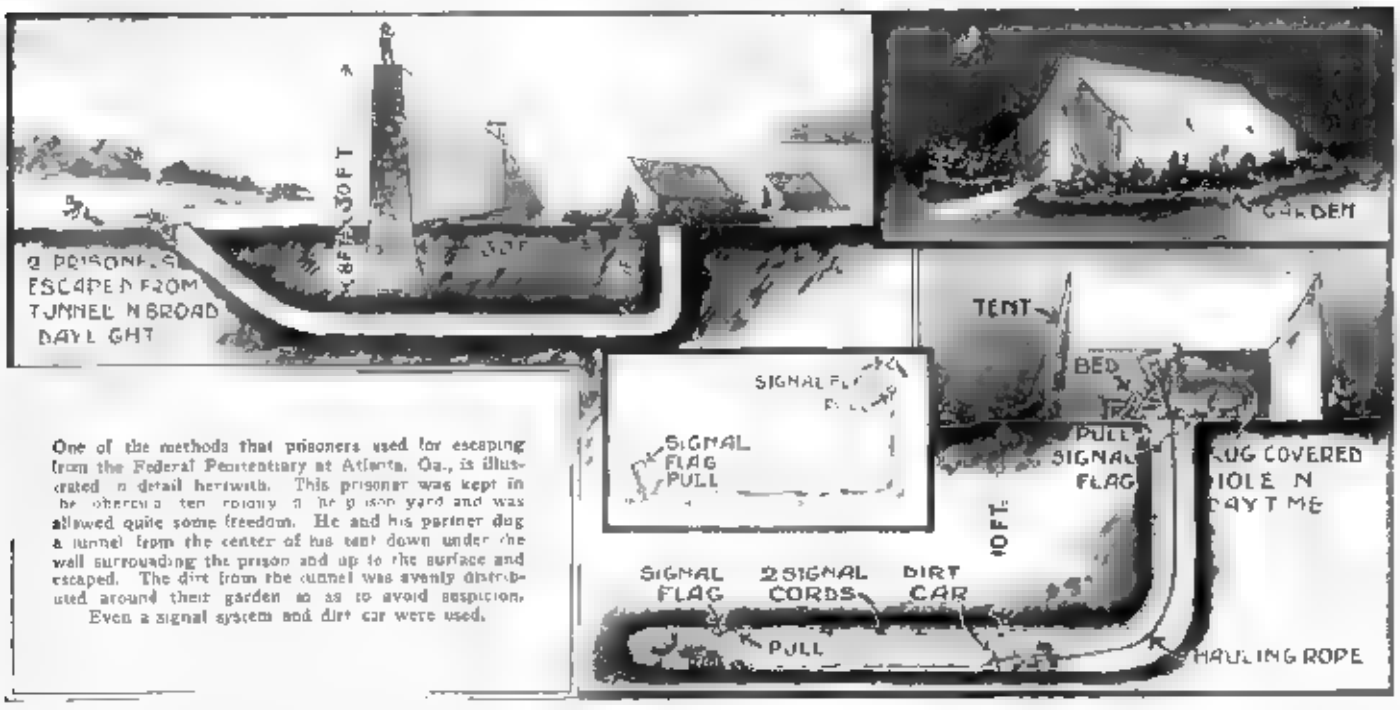
The highest steel bridge in France is the new viaduct over the Garabit viaduct that spans the mountainous Truyère valley. This bridge is most remarkable because of its simple construction and also because of the departure from the usual types of bridges. The structure is across the valley at the point shown by the arrow. The bridge is 400 feet from the bottom of the valley to the roadway.

The arrows point to the location above. Circular staircases and ladders have made every part of the structure this remarkable bridge easily accessible for inspection, painting and repairing. The entire span rests on four concrete abutments.

The diagram at the left is typical of the strength and simplicity of the type of bridge constructed. It relies on the fact that a cylinder is the strongest structure that can be built. Therefore, of course, a semi-cylinder is also very strong. The model at the bridge as it would appear if it were indicates by the arrows the various points of strain. Note how the weight is distributed.

# Science in Prison Escapes

By JOSEPH FELLING FISHMAN, Prison Investigator



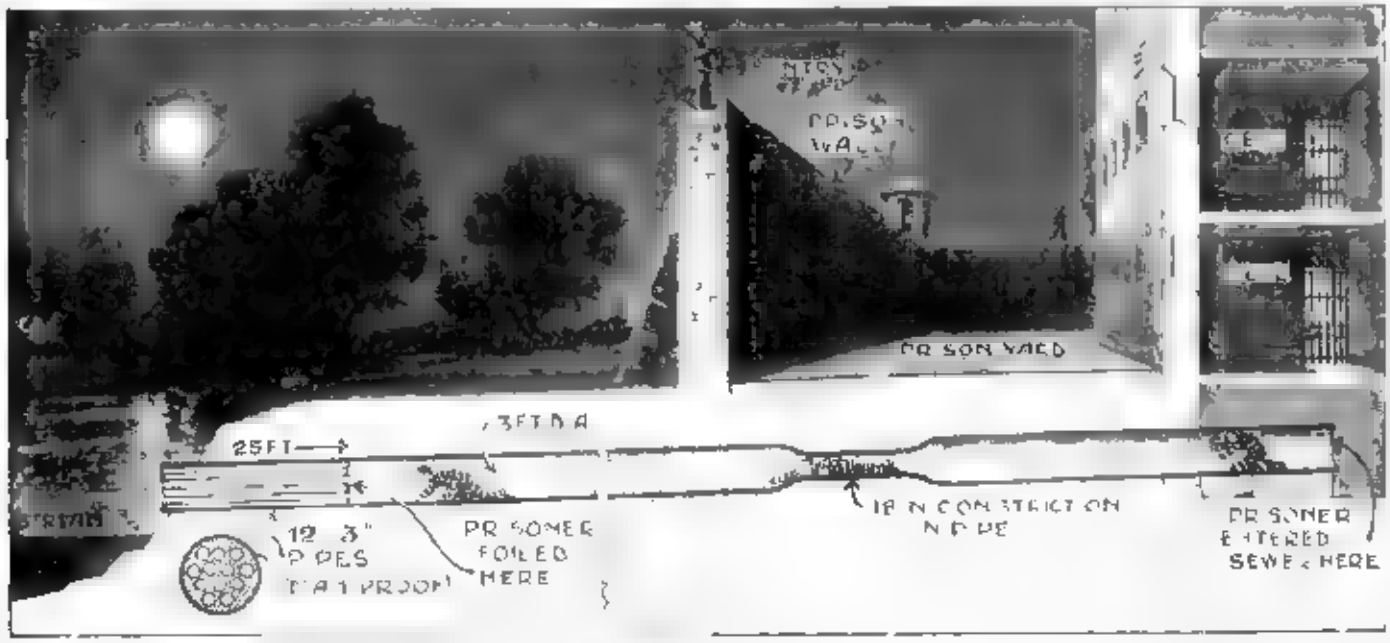

One of the methods that prisoners used for escaping from the Federal Penitentiary at Atlanta, Ga., is illustrated in detail herewith. This prisoner was kept in the observation tent nearest the prison yard and was allowed quite some freedom. He and his partner dug a tunnel from the center of his tent down under the wall surrounding the prison and up to the surface and escaped. The dirt from the tunnel was evenly distributed around their garden so as to avoid suspicion. Even a signal system and dirt car were used.

THE interior of every prison is a seething battle ground between the convicts and their keepers. The prisoners are constantly scheming to outwit the officers and escape, and the officers are scheming with equal ingenuity to keep from being outwitted. In spite, however, of the utmost vigilance, a prisoner will now and then get away. He who said "There is nothing new under the sun" had never been in a penitentiary. Something "new" is always being "pulled off" by both officers and prisoners, and it is very often the ending of one that discloses one can tell how a particular "play" is going to come out.

The prison conduit system may well be called the first aid to the convict because when contemplating an escape the possibility of going out through the underground pipes is always carefully studied. Under every large prison is a veritable maze of piping of every description through which water and wires are carried to the institution and the sewage is taken away. When therefore a prisoner at the Federal Penitentiary at Leavenworth decided upon a getaway his first thought was of "doing a mole," as the prisoner calls burrowing out underground. He worked in the office of the prison superintendent of construction, so it was comparatively easy for him to steal a blueprint which showed where one of the big disposal pipes was located in the new wing which was being built. Being constantly employed in carrying messages to the new wing he found it equally easy to drop below the temporary floor into the cellar and begin his search for the pipe. He found it within a few moments, notwithstanding the fact that the officials had tried to conceal it by covering the end with dirt until such time as it was ready to be connected on the inside. The prisoner scraped the dirt away with a sharp piece of wood and crawled into the pipe head first.

It was easy enough at first, as the pipe had a diameter of about three feet. But suddenly a joint appeared and the conduit was reduced in size to a diameter of about eighteen inches. The prisoner gave a wry

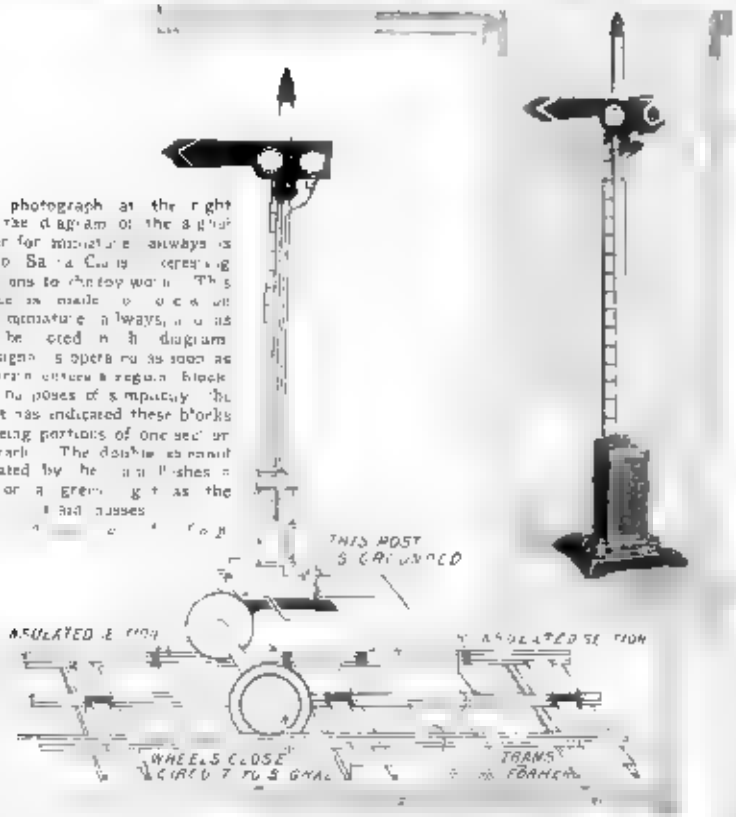
(*Continued on page 764*)



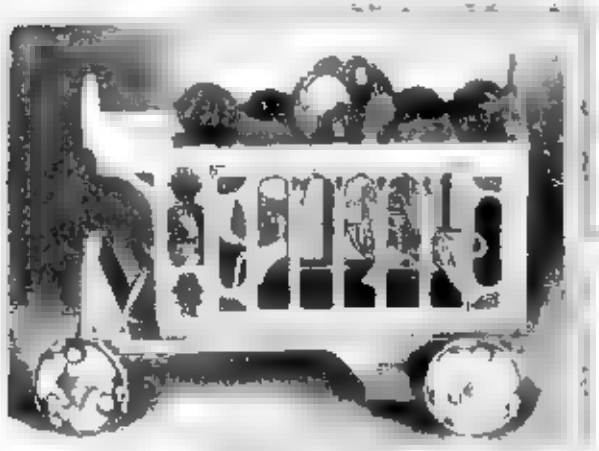

At the Federal Penitentiary at Leavenworth, Kansas, a prisoner tried to escape by crawling through a sewer pipe which he had opined led to freedom. However, the end of the pipe was constructed of a series of 3-inch pipes and so escape was rendered impossible. Imagine the prisoner's consternation.

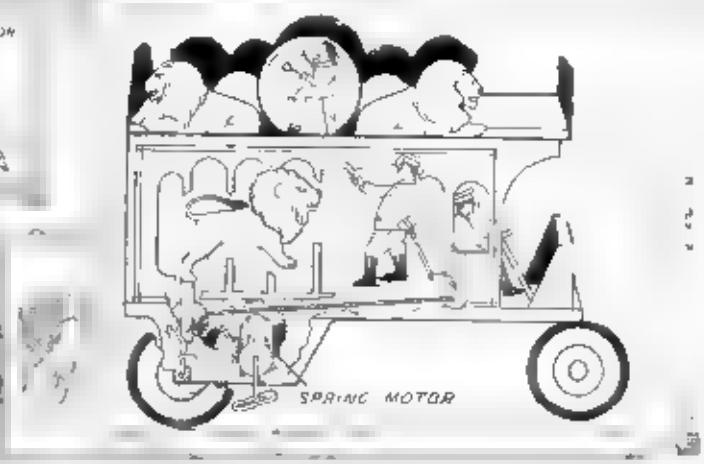
# Scientific Santa

By JOSEPH ...




The photograph at the right and the diagram of the signal tower for miniature railways is one of Santa Claus' interesting additions to toyland work. This device is made ... occasion when miniature railways ... and be ... ected in the diagrams ... signal is operated as soon as the train enters a certain block. For the purpose of simplicity the artist has indicated these blocks as being portions of one section of track. The double armature actuated by the ... pushes a red or a green light as the ... and passes ...



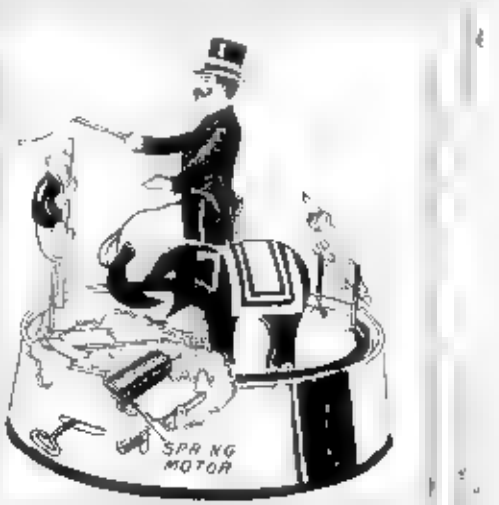



In the above illustration we find the details of a spring wound toy in the form of a circus wagon containing a clown and its trainer. This toy may be wound up and ... is not necessary to hold the wheels while the winding operation is being performed. As soon as the toy is placed on the floor ... and ... rapidly the lion moves up and down and the trainer cracks his whip. The photograph of the toy is ... that of the ... As may be seen by the photograph the device is pleasingly lithographed and there are no sharp corners ... to ... the amusement child. The wheels may be ... on ... ing the toy ... travel in a circle when one is tired of watching ... run straight along ...

See Continued on Page ...

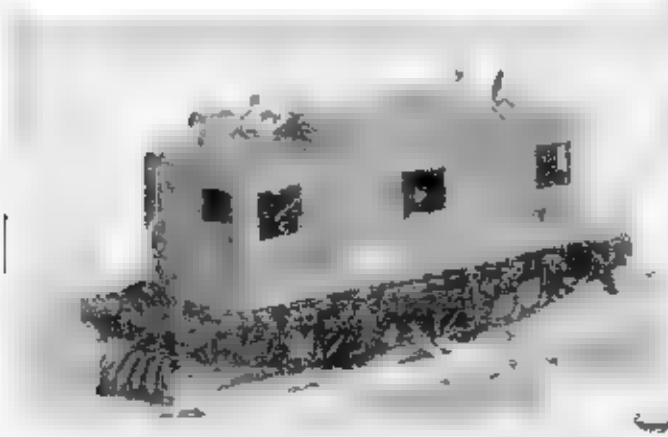
To the right we show a photograph and an illustration of the mechanism of a circus toy in which the master of ceremonies ... runs around and ... cracks his whip at the performers. Each one has a ... to ... down, either the performing animals or the clown go through their respective stunts. The elephant raises on his hind legs, the monkey slides down the pole, the lion stands up, but the clown will not spin around his horizontal bar, but will be hit on the head. Notice in the mechanism that there is a lever with an arrow marked upon it which ... around and raises the animals into their desired position. The clown is merely pivoted on his horizontal bar, consequently the crack from the performer's whip is necessary to make him spin around.

Page Continued from ...

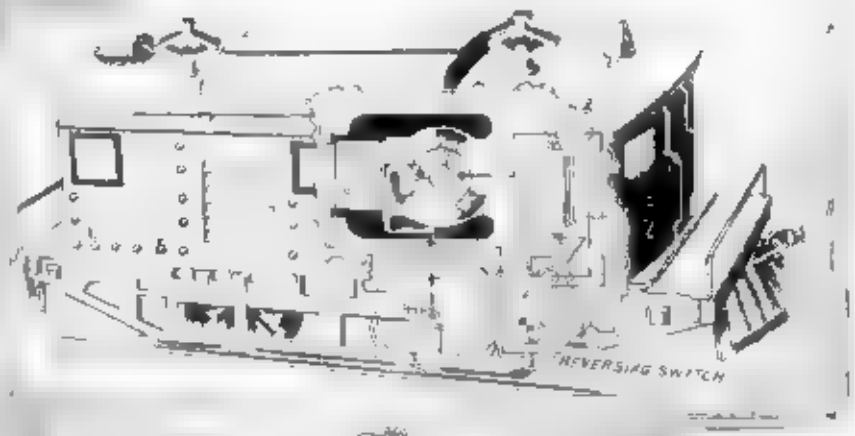


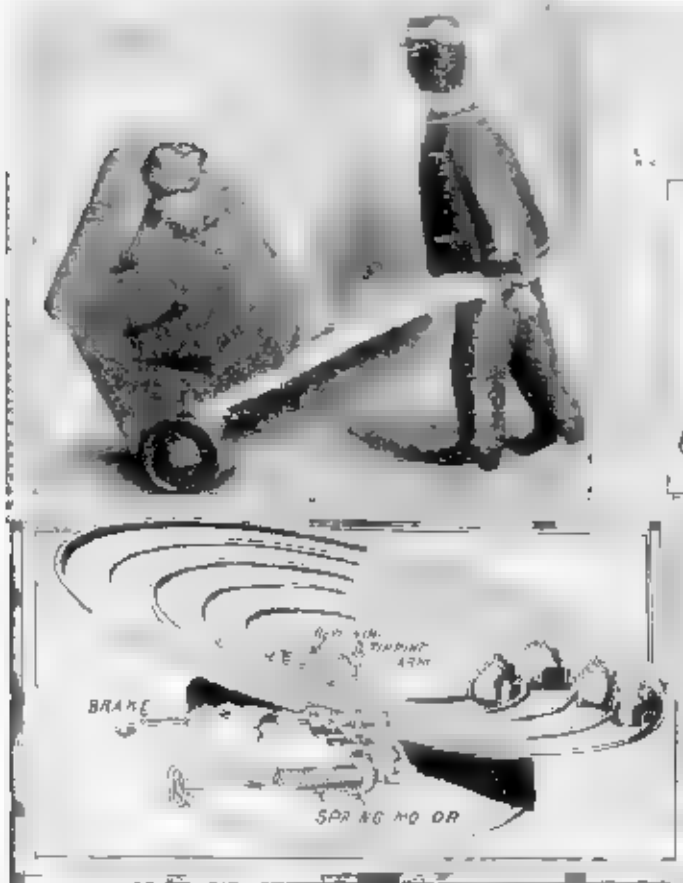
# Delights Children

H. KRAUS



The two photos above and the diagram at the right show the latest type of electric toy railway which reverses automatically when a button on the car is pressed. This button turns off the current to the rails momentarily, and a low-voltage motor controlled reversing switch is then put in the circuit to the rails. The next instant the direction of rotation of the wheels begins to slip with the opposite direction and the toy the train runs backward along the track. This toy is also fitted with a smoke stack which emits puffs of white smoke.

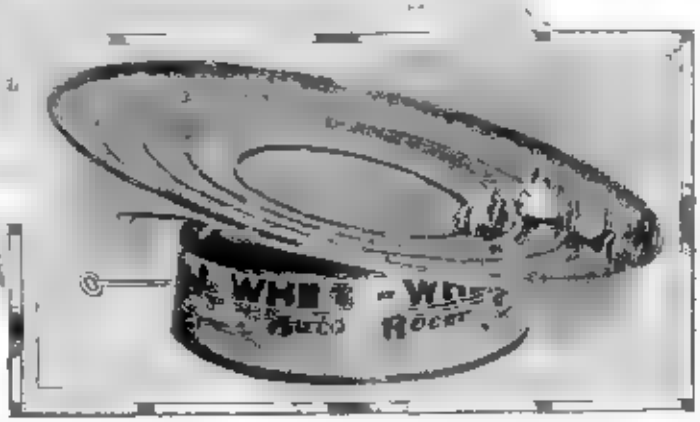



The photo and diagram at the left shows a mechanically operated porter pushing a trunk. As he moves along the floor the cover of the trunk opens up and a dog seemingly growls at the porter who hurries along with his burden. The mechanism is partly applied to the wheels of the porter and yet one wonders at the remarkable way in which the porter walks along the floor. This is made possible through the tangent cranks movement to which the legs of the porter are fixed.

*Model Courtesy Fao & Strauss Co.*




The turntable of the automobile race track illustrated above and to the right is caused to stop progressively by a small revolving tappet arm located immediately below the turn table. Four only automobiles are placed on the track and are caused to race around at a surprising speed. At times the uppermost car will be on the left and at other times any of the other cars will take the lead.

*Model Courtesy Fao Mfg. Co.*

*Address of manufacturer may be had upon request.*

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WRNY

# Science and Invention

40 RADIO ARTICLES

THE MAGAZINE
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# Air Transportation Station of 1950

The uppermost section of this transportation structure, which will consist of a facility within a few decades, is devoted to the handling of freight and baggage, with elevators to bring it to the waiting rooms for passengers. Below this are seen the landing platforms accessible by elevators, to be used by taxiing, ascending or descending airplanes. Running out over the tracks, together with the usual taxiways and waiting rooms. The airplane terminals are plainly illustrated by the drawing arrangement of the loading platforms and aerial ramps.—Reclamation Department

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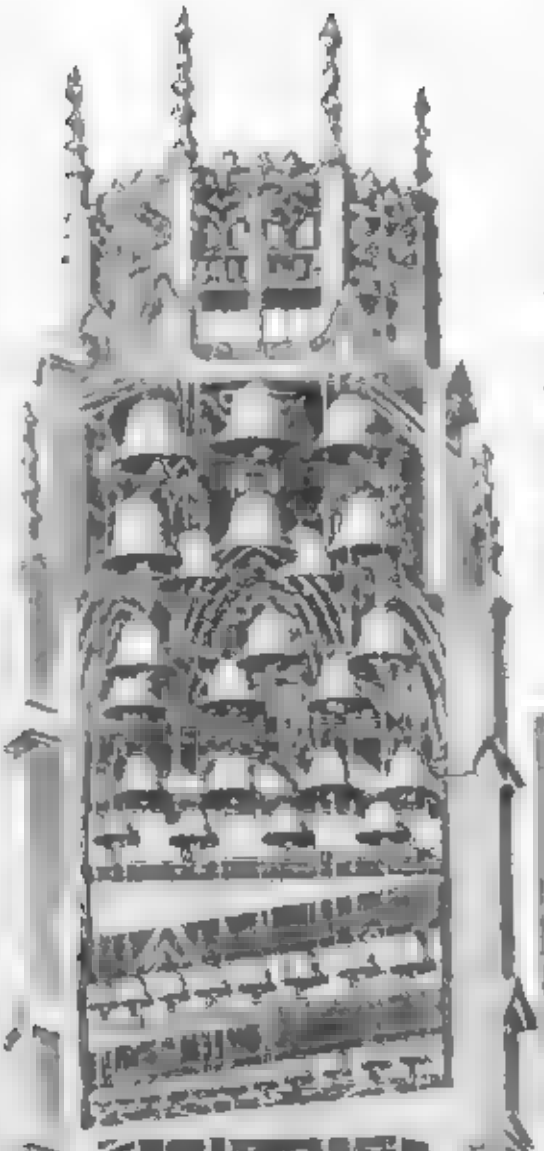
# World's Largest Carillon

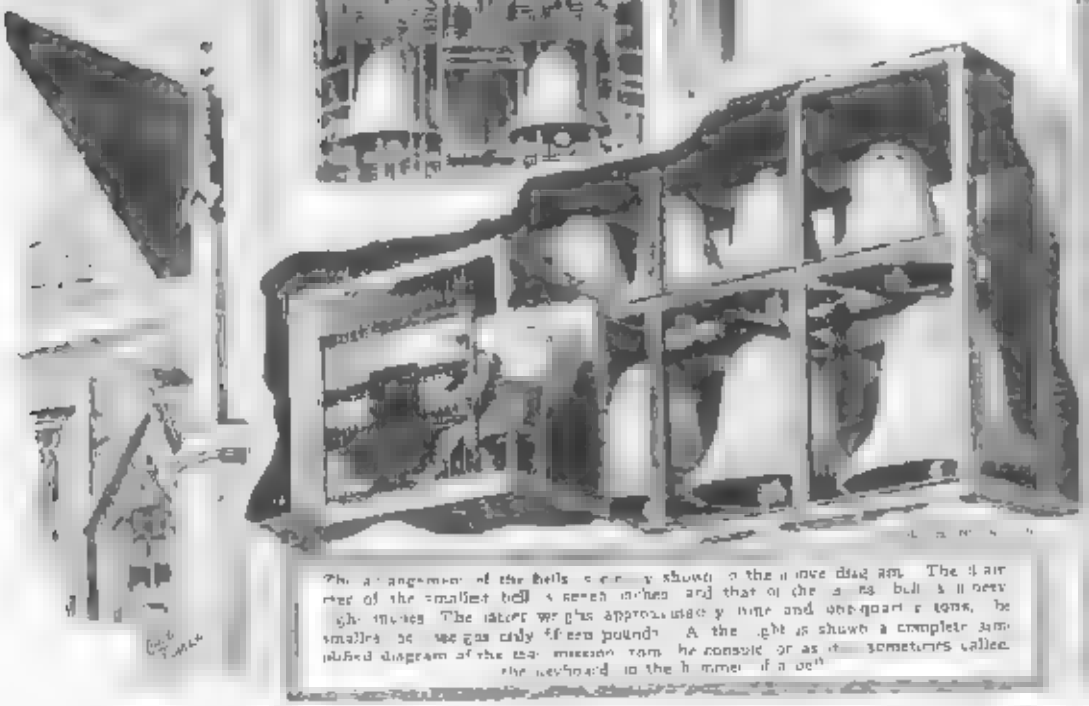
By J. KAY LONDON

One [illegible] as [illegible] on which [illegible] Bar [illegible] New York. This [illegible] I [illegible] 1 [illegible] corresponds with [illegible] private [illegible] The [illegible] The [illegible] The [illegible] scores [illegible] The [illegible] separate [illegible] accommodate [illegible] with [illegible] so [illegible]

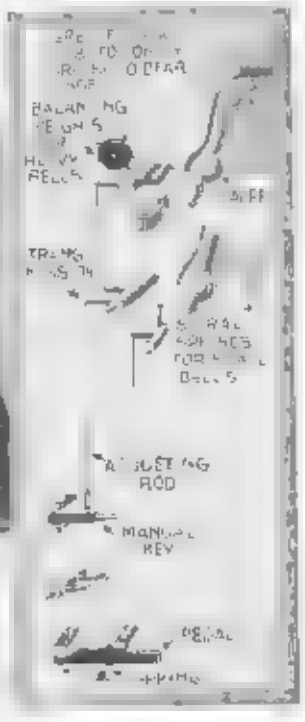
The cutaway diagram [illegible] shows the arrangement of the bells and the position of the console for operating the bells of the largest carillon in the world. This installation is found at the Park Avenue Baptist Church and was presented by John D. Rockefeller, Jr., to the hours. At the present [illegible] the chimes of the concerts are being broadcast via radio.



Pierre Nauwe shows how at the largest bells in the carillon, Arnold Breen, the Belgian carillonneur, is standing between them.



The arrangement of the bells is clearly shown in the above diagram. The diameter of the smallest bell is seven inches and that of the largest bell is nearly eight inches. The latter weighs approximately nine and one-quarter tons, the smallest bell weighing only fifteen pounds. At the right is shown a complete and detailed diagram of the practice room, the console or as it is sometimes called, the keyboard in the hammer of a bell.

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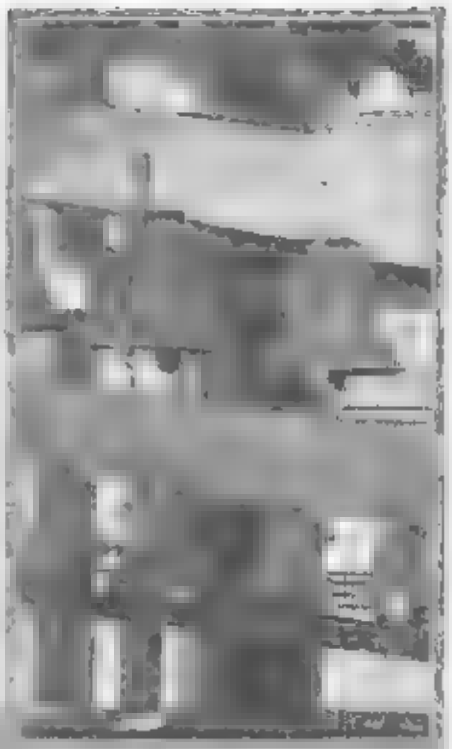
er end of the chromatic scale are operated by hand only whereas the twenty-nine lower bells may be operated by either the hands feet The ham[illegible] counterbalanced by weights and the stroke of the clapper of the larger bell is about two inches

It is not often that a visitor may see the carillonneur at work, but it must be said that this is one of the most interesting sights One might be reminded of a cross between a boxing match and a marathon race As the carillonneur's fingers move along the keyboard he practises out the notes at which he strikes These are connected by means of wires to the hammers of the bells At the same time his feet stamp down upon the pedals To hear Anton Brees play a grand classical number and to watch him operate the keyboard and the pedals is thrill enough for any good pianist Then accompany this sight with the glorious music produced by the [illegible] ever built and the thrill remains to be forever impressed upon your mind.

It is claimed that these bells are tuned on the five tone principle which is said to be rediscovered art Three hundred years ago this method of tuning was known to bell founders at the Netherlands. Among the best known peals of bells tuned by this means are [illegible] Then for centuries the [illegible] years of investigation, [illegible] produced and has now been adopted by all the British bell founders The bells in this new carillon are actually tuned so as to enable the carillonneur to modulate from one key to another at will without danger of consequent discords. When the base bell is struck it continues to reverberate for fully two minutes

This carillon was presented to the Park Avenue Baptist Church by John D Rockefeller, Jr, in memory of his mother Mr Anton Brees, the Belgian carillonneur, who has played all over the world, has been engaged to play the chimes I walking up the tower of the church one will find at the very top three fair sized bells. On a second layer there are five bells, on the third tier there are six bells, each group being progressively smaller and at the same time the bells of the group are individually smaller Immediately under the group of six is another group of eight bells. Two of these have no springs attached to their hammers for bringing the [illegible] back into the striking position [illegible] springs provided for the purpose. Proceeding down further into the [illegible] we come across two groups [illegible] arranged on slanting wood braces There are eight on the upper and eleven on the lower standing brace These bells are nearest the openings in the Gothic structure of the [illegible] Looking down into the tower [illegible] arranged as illustrated on the accompanying page and in a manner best especially for the purpose, the [illegible] bells are arranged.

Anton Brees demonstrated to the writer how easily these bells worked and, pressing the hammer with one finger [illegible] bell, producing the deep characteristic tone of the chime This slowed delicately the hammer was balanced There is sufficient weight on the clapper to cause it to be carried back after it strikes the bell. The bearing point of each clapper is oiled constantly by means of a copper [illegible] connecting with an oil cup. The bells themselves are fixed to their supporting structures by means of two massive bolts passing through the top and fixed to the iron I beams. Each hammer has a safety chain



The above photo shows a few of the bells [illegible] church tower and the photo [illegible] shown [illegible] Anton Brees at the console. There are but three bells all of which are [illegible] by the hands of the player Twenty-nine of them may also be operated by the feet

The photo at the left shows the back of a practice console. It would be impossible to practise on the carillon so this particular console is essential. Orchestral bells with resonators take the place of the [illegible] bells of the carillon. Photo at the right shows the Park Avenue Baptist Church in the tower of which the bells are installed

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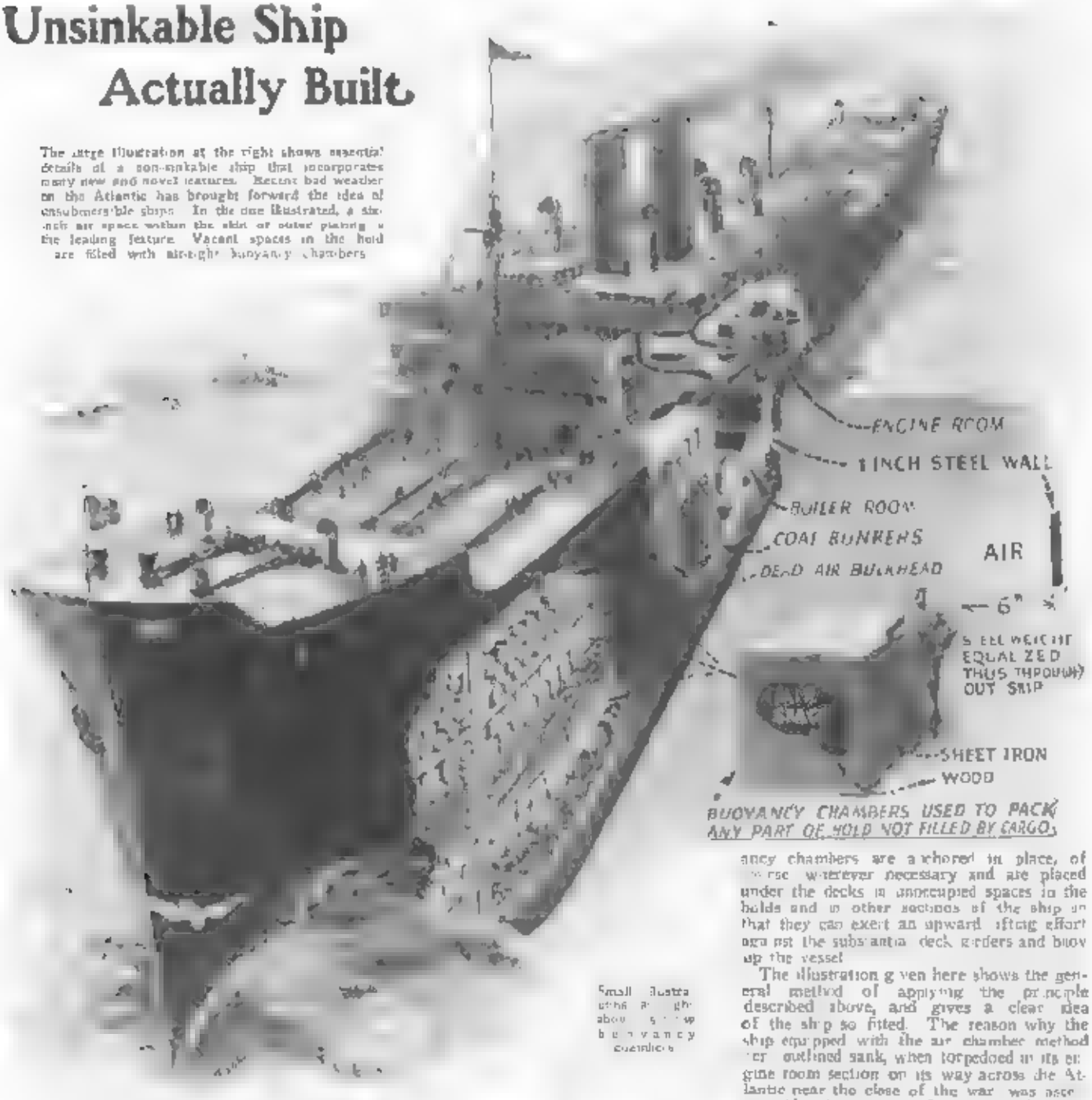
# Unsinkable Ship Actually Built

The large illustration at the right shows essential details of a non-sinkable ship that incorporates many new and novel features. Recent bad weather on the Atlantic has brought forward the idea of unsubmersible ships. In the one illustrated, a six-inch air space within the skin or outer plating is the leading feature. Vacant spaces in the hold are filled with air-tight buoyancy chambers




Small illustration at right above shows buoyancy chambers

THERE have been numerous patents issued, especially during the war, on practically every conceivable kind of unsinkable ship, but it is safe to say that none of these have ever been tried out on anything larger than a small scale model, if they were even carried that far. The exception is the scheme here illustrated and described and which is due to Mr. William T. Donnelly, of New York, the well-known designer and builder of large floating dry-docks. Mr. Donnelly was a member during the war of the Governmental Committee appointed to consider all of the various ideas and suggestions for rendering ships unsinkable. This was one of our greatest problems, if not the greatest, during the World War when the German U-boats were sinking ships daily.

The scheme of Mr. Donnelly's is simple and the best thing about his idea is that it was actually tried out on a number of vessels, including a full-sized steamship. This method of rendering a ship unsinkable was actually carried out during the war and a vessel so equipped traveled across the Atlantic Ocean on a voyage. This ship was torpedoed, but the reason why it did not sink was because the engine room was flooded.

The underlying idea behind the design of the unsinkable ship we have in mind here is that if we provided an air buoyancy space or chamber all around the ship and also in the principal spaces within the ship's hold which are not occupied by cargo, the ship will float even if the sea-cocks are opened, as an actual test of this nature proved.

In other words, if the steel plates on the vessel's hull were one inch thick, and we provided a seven- or eight-inch air space all around the inside of the steel hull, the weight of the steel would be balanced, and ignoring the weight of water which might be taken into the hold if it were empty, the vessel would float. Instead of one great compartment of double-skin construction, air [illegible] chambers [illegible] ous ways to do the same work, and in the ship fitted out according to this scheme, such chambers were made of wood covered with sheet iron with soldered joints to render them air- and water-tight. The buoyancy chambers are anchored in place, of course wherever necessary and are placed under the decks in unoccupied spaces in the holds and in other sections of the ship so that they can exert an upward lifting effort against the substantial deck girders and buoy up the vessel.

The illustration given here shows the general method of applying the principle described above, and gives a clear idea of the ship so fitted. The reason why the ship equipped with the air chamber method later outlined sank, when torpedoed in its engine room section on its way across the Atlantic near the close of the war, was ascertained by the inventor when he saw the manifest indicating how the ship was loaded. Extra heavy cargo was on board and the spaces left in the hold were not filled with buoyancy chambers. The result was that when the water came into the hold its weight overcame the buoyancy of the ship, with insufficient salvage chambers, and it eventually went down, but only after being afloat for 23 hours.

Contrary to an off hand impression, perhaps, that the normal cargo storage space on the ship would be greatly reduced by the use of the buoyancy chambers, the cargo space was only reduced about 15 per cent.

Why are not more experiments carried on with such humanitarian inventions such as this, the reader will ask, and the answer is that it is very difficult as the inventor has found, to get shipbuilders to try out these ideas. Furthermore, the big maritime insurance companies have no desire to see any such invention as this come into the field of ocean transport, for when once it has been proven successful and is adopted by the large ship operating and building companies, the the rates for insurance on ships and cargoes will be greatly reduced.

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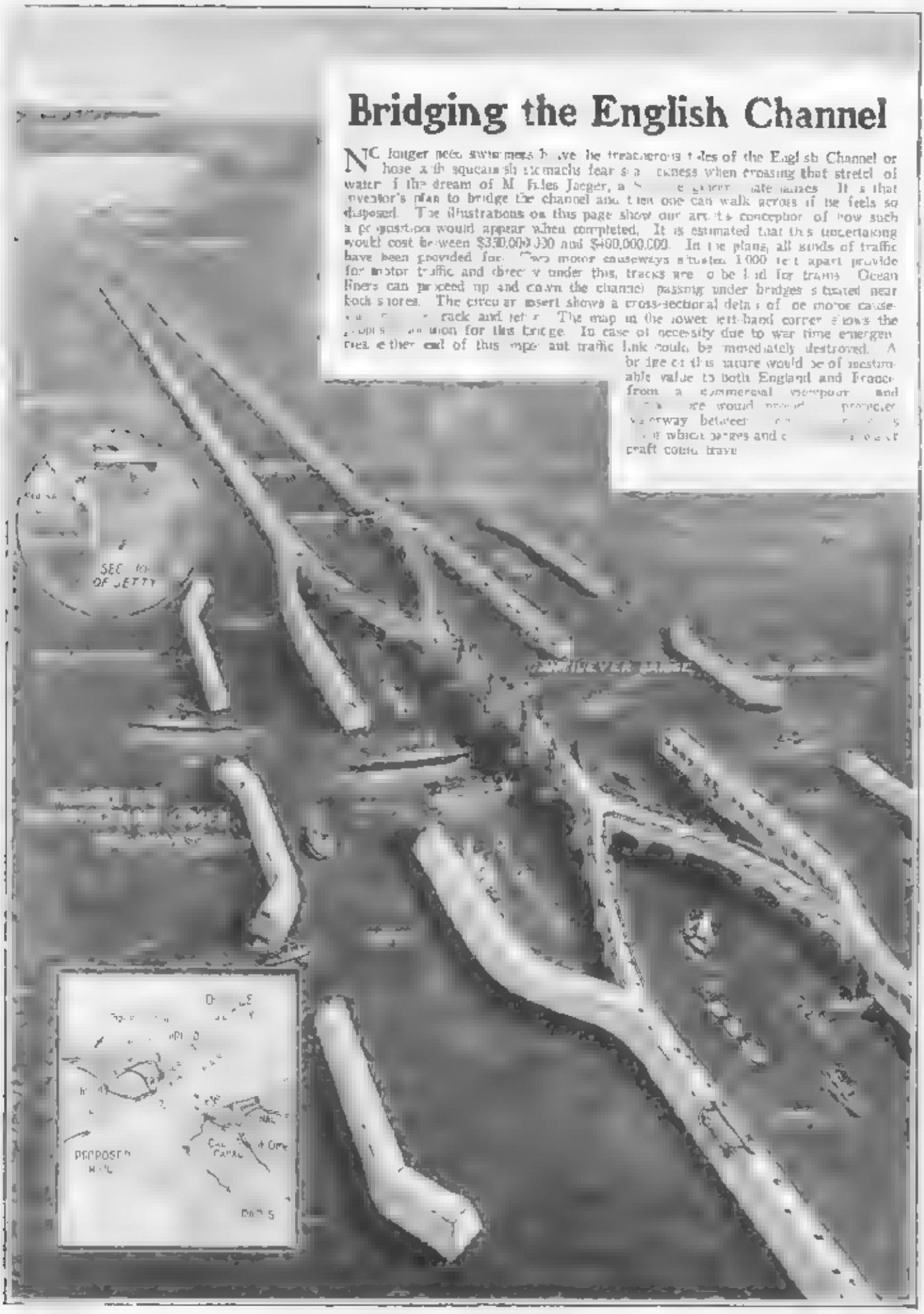
# Bridging the English Channel

NO longer need swimmers have the treacherous tides of the English Channel or those with squeamish stomachs fear seasickness when crossing that stretch of water if the dream of M. Jules Jaeger, a [illegible] engineer, materializes. It is that inventor's plan to bridge the channel and then one can walk across if he feels so disposed. The illustrations on this page show our artist's conception of how such a proposition would appear when completed. It is estimated that this undertaking would cost between $330,000,000 and $400,000,000. In the plans all kinds of traffic have been provided for. Two motor causeways situated 1,000 feet apart provide for motor traffic and directly under this, tracks are to be laid for trains. Ocean liners can proceed up and down the channel passing under bridges situated near both shores. The circular insert shows a cross-sectional detail of the motor causeway, railroad track and tube. The map in the lower left-hand corner shows the proposed location for this bridge. In case of necessity due to war time emergency, either end of this important traffic link could be immediately destroyed. A bridge of this nature would be of inestimable value to both England and France from a commercial viewpoint and [illegible] would provide a perfect highway between [illegible] over which barges and [illegible] craft could travel.

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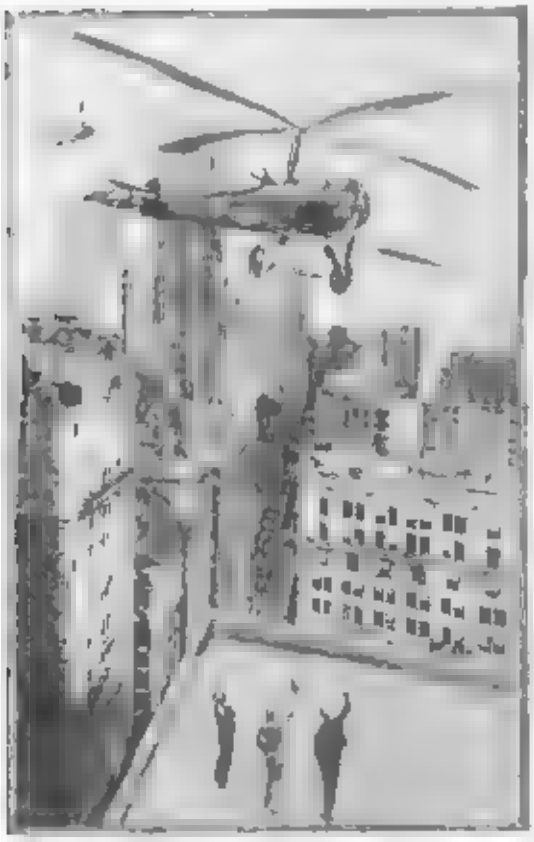
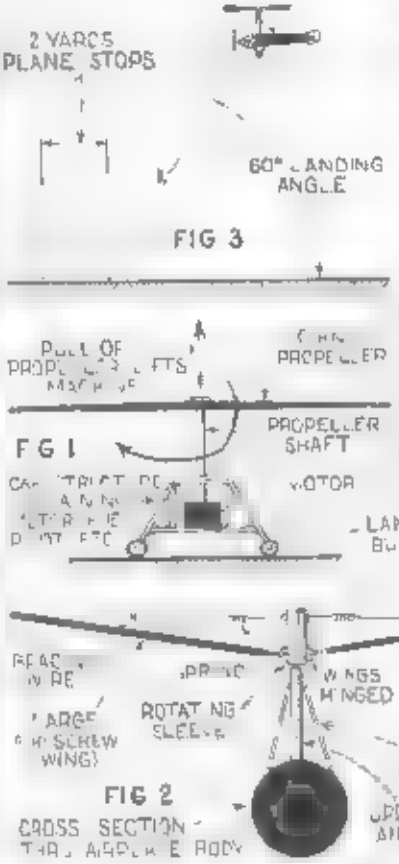
# New Helicopter-Airplane

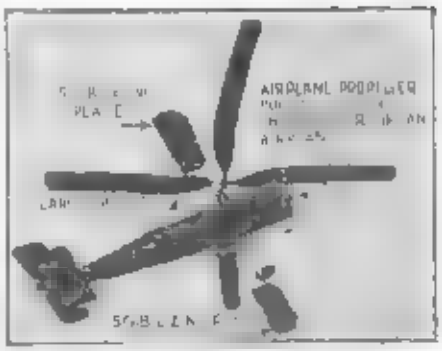
By C. A. OLDROYD

Aeronautical Engineer Reporter No. 4435 (English Correspondent)



An artist's conception of the new helicopter in flight over New York City. A machine of this kind could land on ordinary flat building tops, as no special landing fields are required.




Above—Actual photograph of auto-gyro in flight. Important features indicated.

Fig. 1. A standard helicopter. Fig. 2. A diagrammatical view of the auto-gyro showing location and general principle of the airscrew, which allows vertical flight. Figs. 3 and 4 show two methods of landing such a machine.

A SPANISH engineer, Señor de la Cierva, has at last given to the world what appears to be the perfect flying machine. Recent tests carried out in England by the Air Ministry of Great Britain show beyond doubt that the new machine fulfils all demands that can be reasonably made on any flying machine.

We all have some time or other built flying machines, for the kite is really the simplest type of aerial machine. The surface of the kite is at an angle to the wind direction, and the air pressure produced by the wind lifts the kite. The air pressure is opposed by the pull of the kite cord, so that the kite cannot drift away with the wind but is forced to rise. Stability to the whole is given by a long tail.

The airplane is based on the same principle, only here the kite cord is replaced by the pull of the propeller. The propeller draws the machine through the air and the pressure against the wings lifts the machine upward. Fixed tail surfaces serve the same purpose as the feathers at the end of an arrow, they maintain the machine in straight flight. By means of rudders and elevators, the pilot can direct the flight of the machine.

And, finally, we have the helicopter. One type is illustrated in Fig. 1. The lifting action is produced by a giant airscrew mounted above the structure that serves as landing chassis and car. As the motor turns the propeller, the machine lifts off the ground, and from now onward flies by hanging from the lifting airscrew.

Stability is therefore most difficult to attain with a machine of this type for the wind currents interfere most seriously with the air currents around the lifting airscrew. None of the true helicopters yet constructed can be called entirely successful and it is doubtful whether the world will ever see a thoroughly satisfactory machine of this type.

The greatest drawback of the helicopter is that engine failure spells a crash, resulting in a more or less complete wreck of the machine.

The new auto-gyro flying machine combines the advantages of the airplane and the autogiro, without possessing any of their drawbacks. It is small and compact like the airplane, and capable of high speed with low power. In addition, however, it can land in the smallest space, and as the latest experiments made prove, it can even descend vertically.

The photo shows the experimental machine in flight. This has been constructed from a standard airplane after the original wings had been removed. Just behind the pilot's cockpit an upright steel tube has been fitted, on which the large horizontal airscrew—the essential feature of this machine, is supported. Short steel tube stays to the side of the airplane body hold the upright rigid.

This airscrew is, however, not power-driven, as in a helicopter, *but revolves freely in the air as the machine travels through the air.* The airscrew consists of four light, narrow wings, each seventeen feet in length, at the root these wings are hinged to a rotating sleeve which goes over the steel upright (Fig. 5). The wings are supported by bracing wires between the end of these wires and the sleeve strong springs are inserted.

Before discussing the action of the large airscrew let us follow the various stages of flight of this new auto-gyro. Before the pilot can take off, the large airscrew must be started. In the experimental machine shown in the pictures no provision has been made to start the airscrew by power, so it must be done by hand. A rope is wound a few times around the rotating sleeve and several men pull, causing the large airscrew to rotate slowly on its ball-bearing sleeve.

The engine of the machine, which drives the front propeller is now started, and the pilot takes off. We notice that the large horizontal airscrew turns faster and faster as the machine runs over the ground, when a speed of about 120 revolutions per minute has been reached, the large airscrew will support the whole weight of the auto-gyro. Flight is now controlled in the usual manner by means of rudders and elevators. The pilot now makes a landing, and a very sudden one, too, for the machine descends at an angle of about 60 degrees to the horizontal. The landing wheels touch the ground, and in only two yards the auto-gyro comes to a dead stop! No airplane could possibly perform a similar feat.

But the pilot has some more surprises in store for us, he ascends again, and when he has reached a height of about 200 feet, he cuts off his engine. An airplane would glide down to the ground, not so with the auto-gyro. The large airscrew above the body continues to rotate slowly and the auto-gyro sinks down slowly to the earth, descending almost vertically. Without any severe shock, the landing wheels touch the ground, and again the machine comes to rest within a yard or two.

*(Continued on page 876)*

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# Submarine Opens Frozen Rivers

By JOSEPH H. KRAUS

The above illustration is an artist's conception of the proposed method of opening navigation in rivers which are frozen over during cold winters. The drawing further illustrates the particular style of bomb liberated by submarines, which could be employed for blasting away the ice formations.

MANY attempts have frequently been made to open river navigation, which, due to severe weather, may be frozen up for a good part of the winter season. In spite of all the engineering ingenuity that has been expended in the solution of this problem, no really satisfactory method has been developed. The chief obstacles to be overcome are those of a vague and undetermined character, which could be removed only by a thorough knowledge of the conditions as they actually exist.

The following method of opening the ice-bound rivers has been suggested by a well-known engineer. It is based on the principle that the explosive charge will be more effective if placed under the ice than if placed on top of it. The charge rises and falls constantly.

The boats cannot possibly break through very heavy ice formations in a short space of time, and thousands of dollars are lost [illegible] their non-delivery.

The airplane seems to be ideally suited for this kind of work. First, the charges dropped from the airplane are invariably scattered over large areas. During very severe weather it is dangerous to risk the life of the aviator, and the plane itself cannot carry a sufficient number of bombs to permit of a thorough work over large areas.

[illegible] has been suggested that the submarine be used to overcome the difficulties under which the other systems must operate. The inventor believes that if the submarines were equipped with [illegible] of the drawbacks would be overcome. These bombs [illegible] located around the periphery of the bomb which, on coming in contact with the ice, ignite the time fuse. This time fuse is so regulated that the submarine has [illegible] opportunity to get out of the way of the [illegible] it sinks to the bottom and there detonates. It is better to have the bomb destroyed in this manner than to permit it to float around as a menace to navigation.

[illegible] this way, the submerged vessel would never [illegible] through tortuous rivers and dangerous channels.

Keep your eyes open for the February issue of SCIENCE AND INVENTION magazine containing the list of prize winners in our recent CLOCK SPRING Contest. The judges are still busy inspecting the prize winning ideas and their decisions will be published in the next issue. Again, don't forget the $5,000.00 Matchcraft Contest. For the information concerning this will be found on page 849

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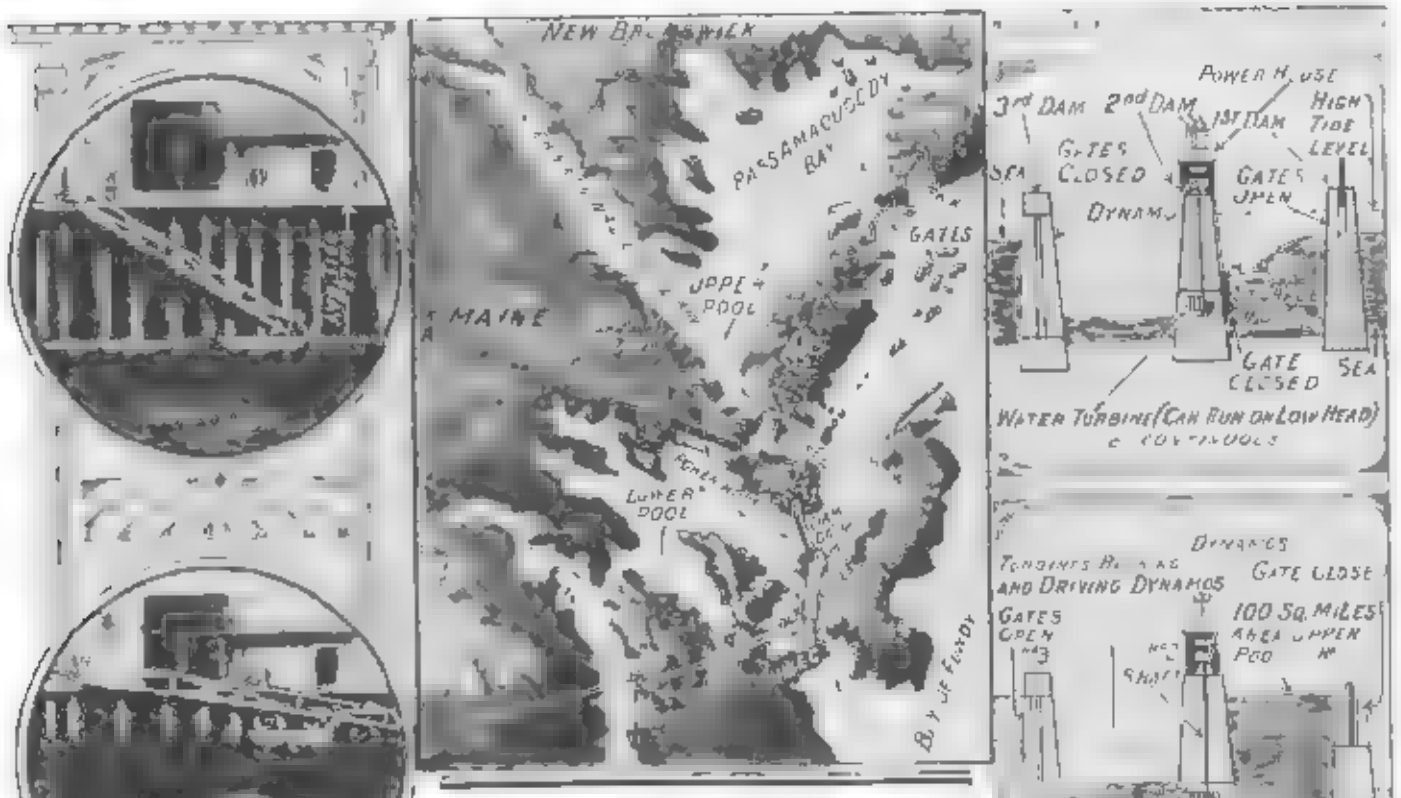
# Harnessing Bay of Fundy's Tides




A proposed system of harnessing the tides in the Bay of Fundy is illustrated here. In this remarkable bay the tide rises as high as 27 feet. Inasmuch as the rise is sometimes irregular, the tides are not made use of directly but are made to fill a huge storage pool formed by a natural bay and a dam. This storage pool is then used to generate electricity as shown in the simplified diagrams at the right. The complete system is thoroughly described in the text. A map of the Bay of Fundy with proposed dams is shown above.

TIDAL power has been the dream of many engineers, but so far practically none of this vast natural power has been applied for the benefit of man. Possibly one of the reasons why engineers and their financial backers have hesitated to build the necessary storage reservoirs or basins in which to trap water at high tide, this being one of the principal features of the methods advocated, is due to the fact that, except for a few locations on the earth, the tidal rise and fall is not so great as it is, for instance, at the Bay of Fundy just off the northeast coast of Maine. Startling as it may seem to those who have not seen this daily rise and fall of the waters, the tide at this famous location rises and falls from 21 to 27 feet twice a day.

Mr. Dexter P. Cooper, a leading American hydraulic engineer, has become so interested in the possibilities of harnessing these great tides of the Bay of Fundy, that he finally got the whole state of Maine interested also, with the result that, within the next few years, we may see one of the greatest water power developments at this point that the world has yet witnessed.

## GREATER THAN MUSCLE SHOALS

The possibilities for power development at the Bay of Fundy location are considerably greater than at the famous Muscle Shoals power dam. In a recent interview with Mr. Cooper, he said that the greatest possible development at Wilson Dam, Muscle Shoals, is 700,000,000 kilowatt hours a year, while at the Bay of Fundy the amount of continuous dependable power will be at the rate of 3,268,000,000 kilowatt hours a year. In other words, the Bay of Fundy scheme has potential power possibilities four times greater than those of the Wilson Dam plant.

Comparing the Muscle Shoals plant with the proposed Bay of Fundy development it is interesting to note that when the Tennessee River is full, this plant will develop 600,000 horse-power and only 100,000 horse-power when the river is low, the Bay of Fundy power site will, it is estimated, provide at least 500,000 horse-power steadily. Engineer Cooper states further that eventually the power developed can be increased to 700,000 horse-power, sufficient to supply all New England and more.

## AREA OF RESERVOIRS 150 SQ. MI.

The accompanying sectional diagrams and map show the simplicity of this scheme for harnessing the tides of the Bay of Fundy. The storage reservoirs are divided into lower and upper pools. The upper pool or main storage reservoir will have an area of approximately 100 square miles, and the lower pool one of about 50 square miles. The gates of the upper storage reservoir will be opened as the tide rises and a vast amount of water will be thus impounded from the sea. At maximum high tide and when the water level inside the upper storage reservoir is the same as that outside the gates they will be closed. Water will be released practically continuously according to Mr. Cooper's plans, through the power house dam and water turbines into the lower pool. Water from the lower pool will be emptied back into the sea at low tide by opening the gates in the third dam, as the diagrams show. It will be seen that if it was not for this third dam the tide would fill the smaller or lower basin at the same time and to the same level as the upper basin, and thus the turbines could not operate until the tide had fallen to its lowest point again or nearly so.

That it will be seen that Mr. Cooper has very ingeniously worked out his proposed development for exploiting the tides of the Bay of Fundy, for by utilizing the two basins and the three dams, he is able to operate his water turbines and dynamos 24 hours a day if he so desires. The dam at the mouth of the upper pool will have to be about 4,000 feet, nearly a mile, in length, and 70 feet in height. This great wall will contain 33 massive gates. The opening from the lower pool to the sea will have to be closed by a dam about half a mile long, provided with an adequate number of gates, which will be operated as aforementioned and as shown by the diagrams. The intermediate power house dam, separating the upper and lower pools, will be about 3,600 feet in length. Power houses will be built on the dam.

Mr. Cooper estimates that it will require a regiment of men, or about 5,000, working over a period of five years to construct the huge dams and gates. The monetary cost of this huge operation would run up to about $75,000,000. One of the problems the engineers had to figure on was the fact that the state of Maine has a law prohibiting the

(*Continued on page 873*)

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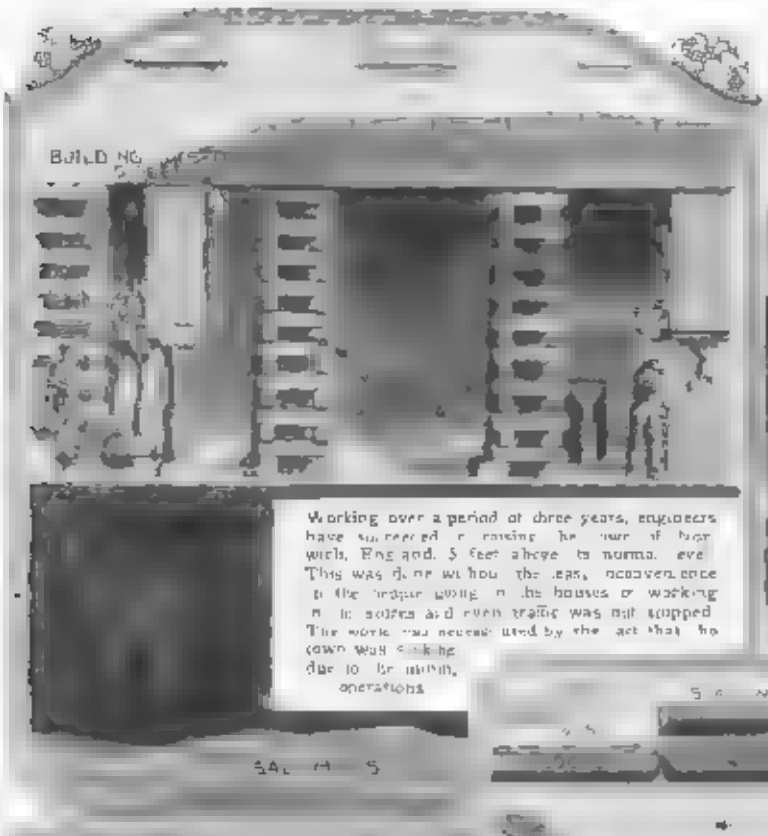
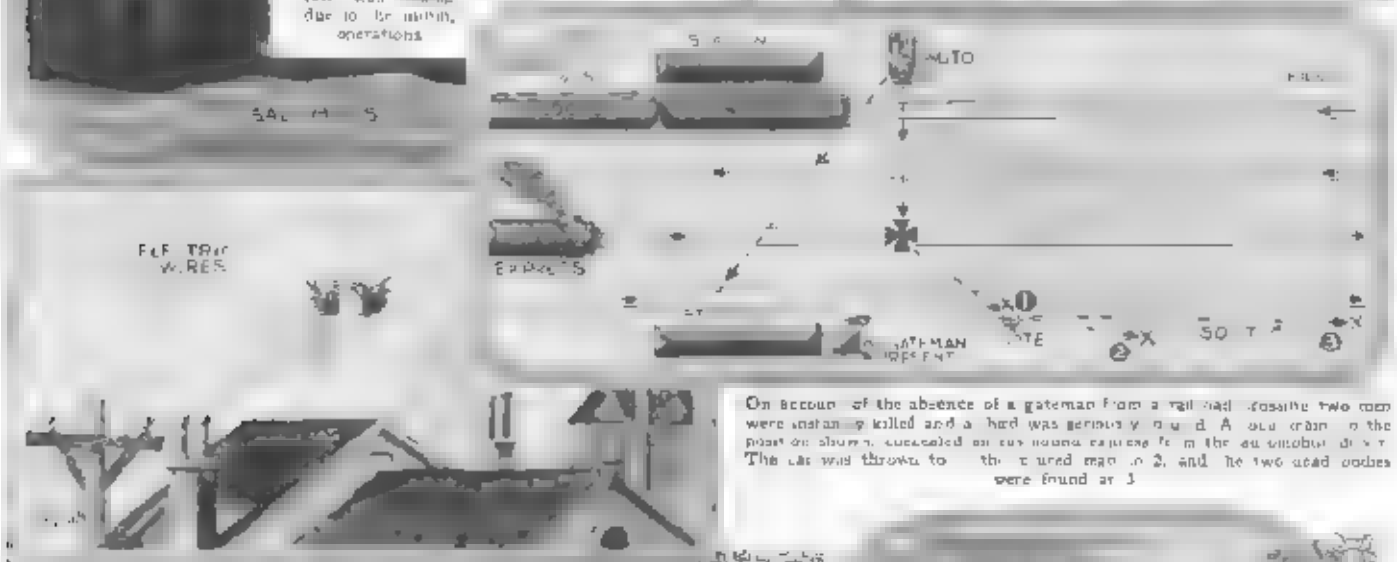
# The Month's Science News Illustrated

Illustrated by George Wall



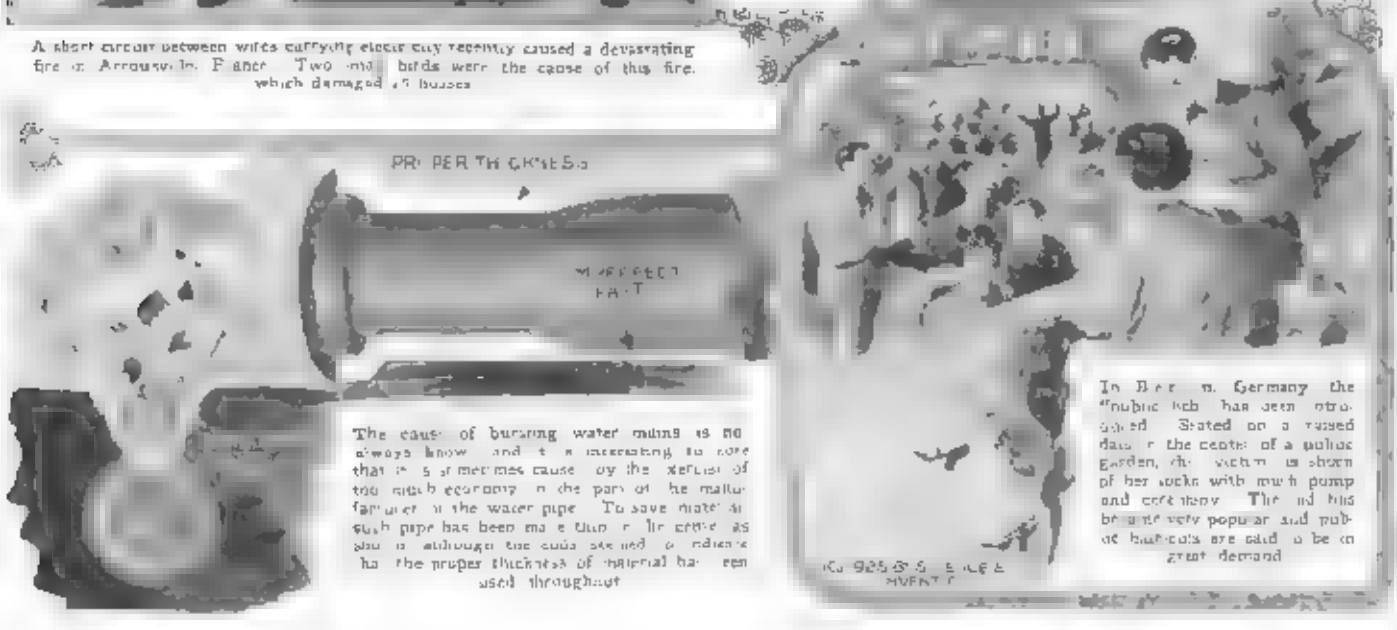
Working over a period of three years, engineers have succeeded in raising the town of Hyde Park, England, 5 feet above its normal level. This was done without the least inconvenience to the people living in the houses or working in the stores and even traffic was not stopped. The work was necessitated by the fact that the town was sinking due to the mining operations

Upon a farm near Idaho Springs, Texas, a lake nearly an acre in area and armed for the piscatorial supply of fish recently developed because the roof of a huge cavern above it collapsed and all of the water was drained off



A short circuit between wires carrying electricity recently caused a devastating fire in Arrouaille, France. Two wind birds were the cause of this fire, which damaged 45 houses

On account of the absence of a gateman from a railroad crossing two men were instantly killed and a third was seriously injured. An automobile driven by the gateman crossed on the tracks directly in the path of the oncoming express train. The car was thrown to the injured man at 2, and the two dead bodies were found at 3



The cause of bursting water mains is not always known, and it is interesting to note that it is sometimes caused by the desire of too much economy on the part of the manufacturer of the water pipe. To save material such pipe has been made thinner in the middle as shown, although the ends are of the proper thickness of material that has been used throughout

In Berlin, Germany, the "public itch" has been stimulated. Seated on a raised dais in the centre of a public garden, the victim is shown one of her socks with mouth pump and corn-cure. This idea has become very popular and public barbecues are said to be in great demand

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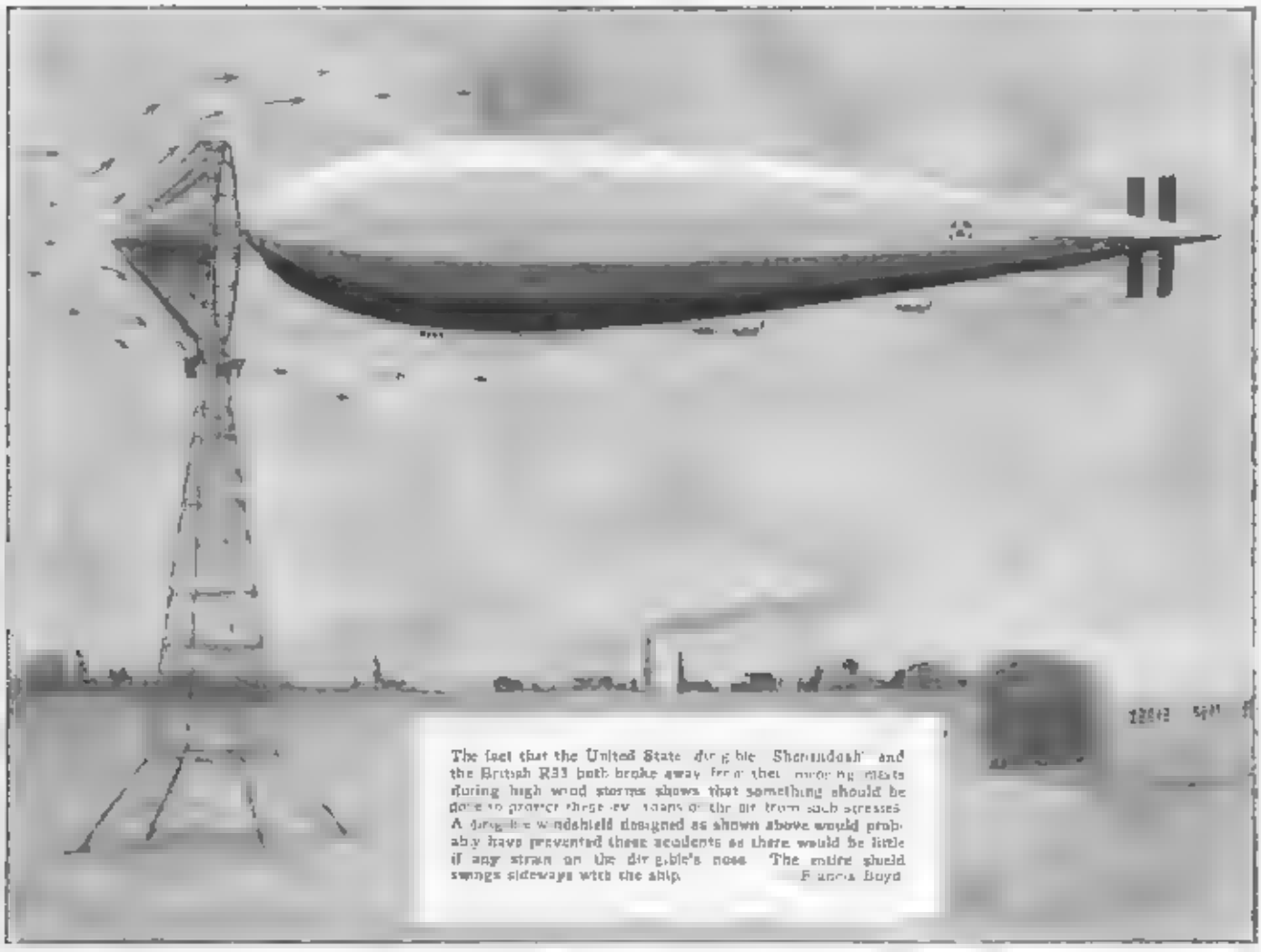
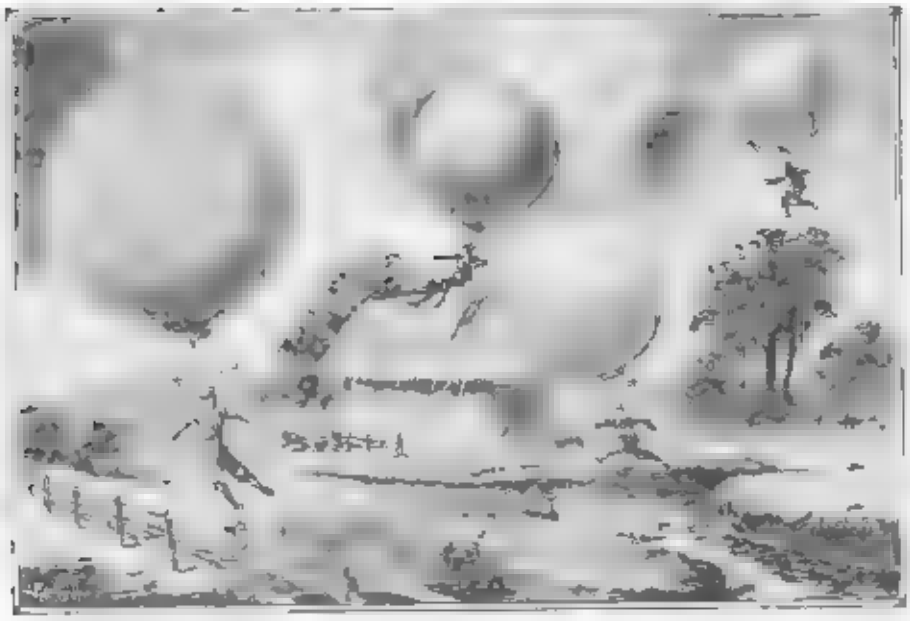
# Shielded Mooring Mast



The fact that the United States dirigible Shenandoah and the British R33 both broke away from their mooring masts during high wind storms shows that something should be done to protect these envelopes of the air from such stresses. A dirigible windshield designed as shown above would probably have prevented these accidents as there would be little if any strain on the dirigible's nose. The entire shield swings sideways with the ship. — Francis Boyd

# Balloon Jumping Sport



FROM London we have received word of the very latest fad in the line of sports. All that you have to do to indulge in this exhilarating pastime is to provide yourself with a small balloon that is not quite buoyant enough to lift you completely off of the ground. This is to be strapped to your body [illegible] you are ready to go out and hop over a house, across a wide stream and even over fences and trees. A slight push of your feet against the earth will send you many feet into the air. You will float back toward the ground and if your balloon is filled properly, you will land as light as a breeze blown thistle. By properly directing the pressure against the ground and possibly by manipulating the body while in the air it should not take long for anyone to so place himself in control of his balloon that he can land at almost any desired spot within reason. Races with balloons of this sort would undoubtedly be great fun and the danger would be very slight. Obstacle races of course would be the most fun because you then bring the advantages of the balloons into full play. We hope to soon see this sport developed by some American balloon manufacturer in this country.

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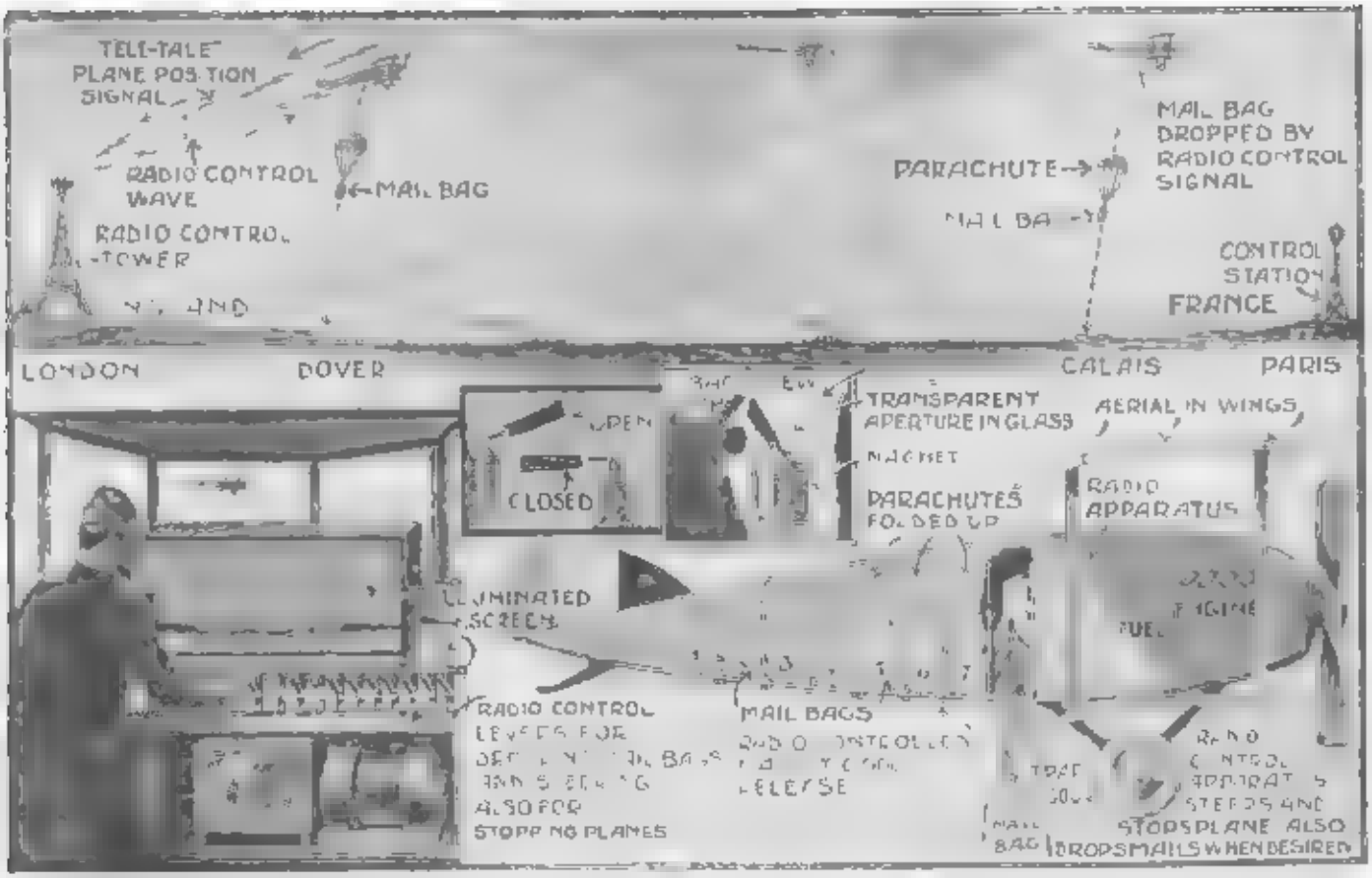
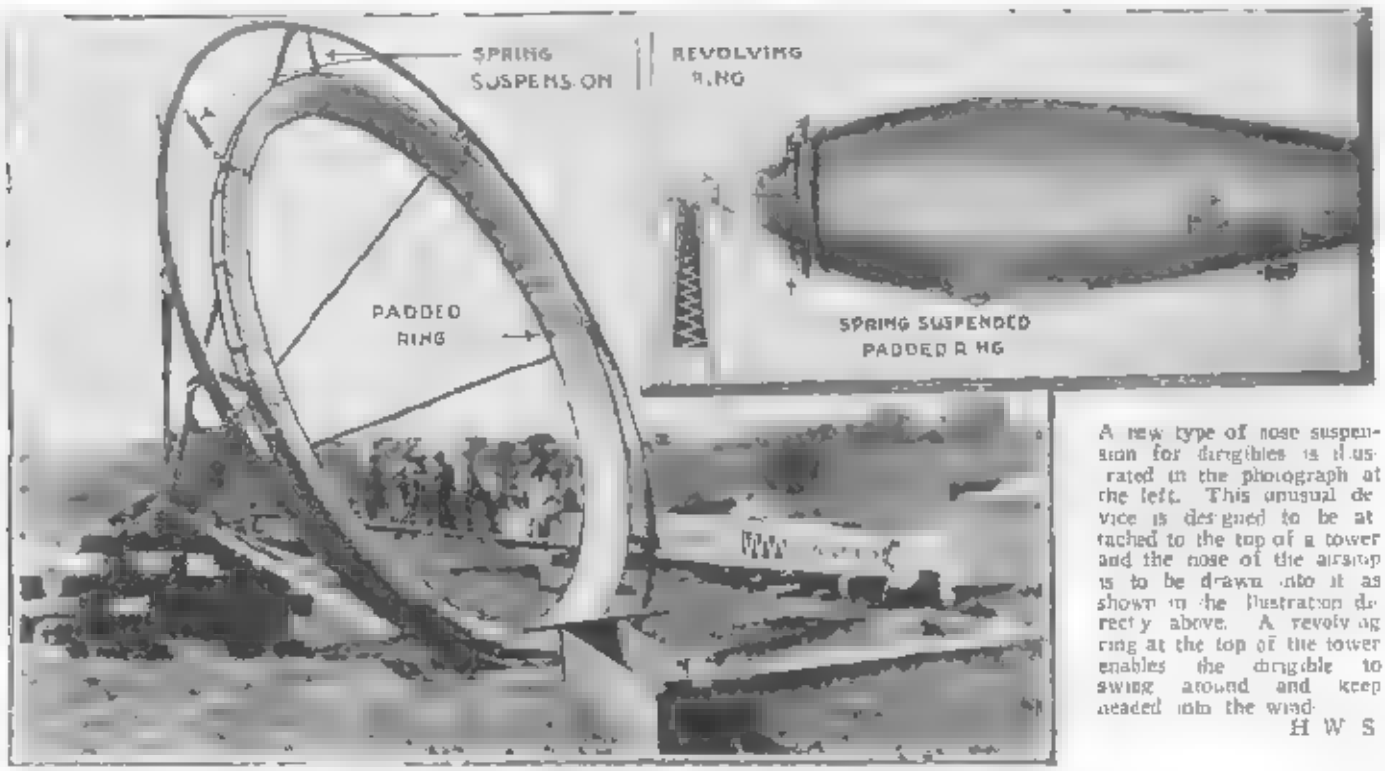
# Radio Controlled Air Mail Planes




O. T. Eash designs a radio apparatus whereby a small plane may be directed and in operation above. A continuous series of signals sent out from the plane will illuminate apertures in a ground glass screen placed in front of an observer at one of the stations as shown in the center illustration, at any time. The details of this mechanism are given in the center illustration. The mail is dropped by parachutes. —H. T. Wilkins

# Padded Ring Holds Dirigible




A new type of nose suspension for dirigibles is illustrated in the photograph at the left. This unusual device is designed to be attached to the top of a tower and the nose of the airship is to be drawn into it as shown in the illustration directly above. A revolving ring at the top of the tower enables the dirigible to swing around and keep headed into the wind. H W S

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# Science and Invention

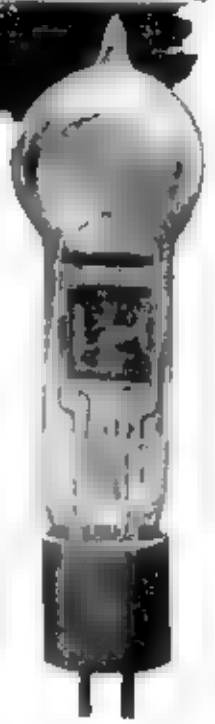
## THE LIGHT-BEAM PIANO

*See Page 896*

40 RADIO ARTICLES

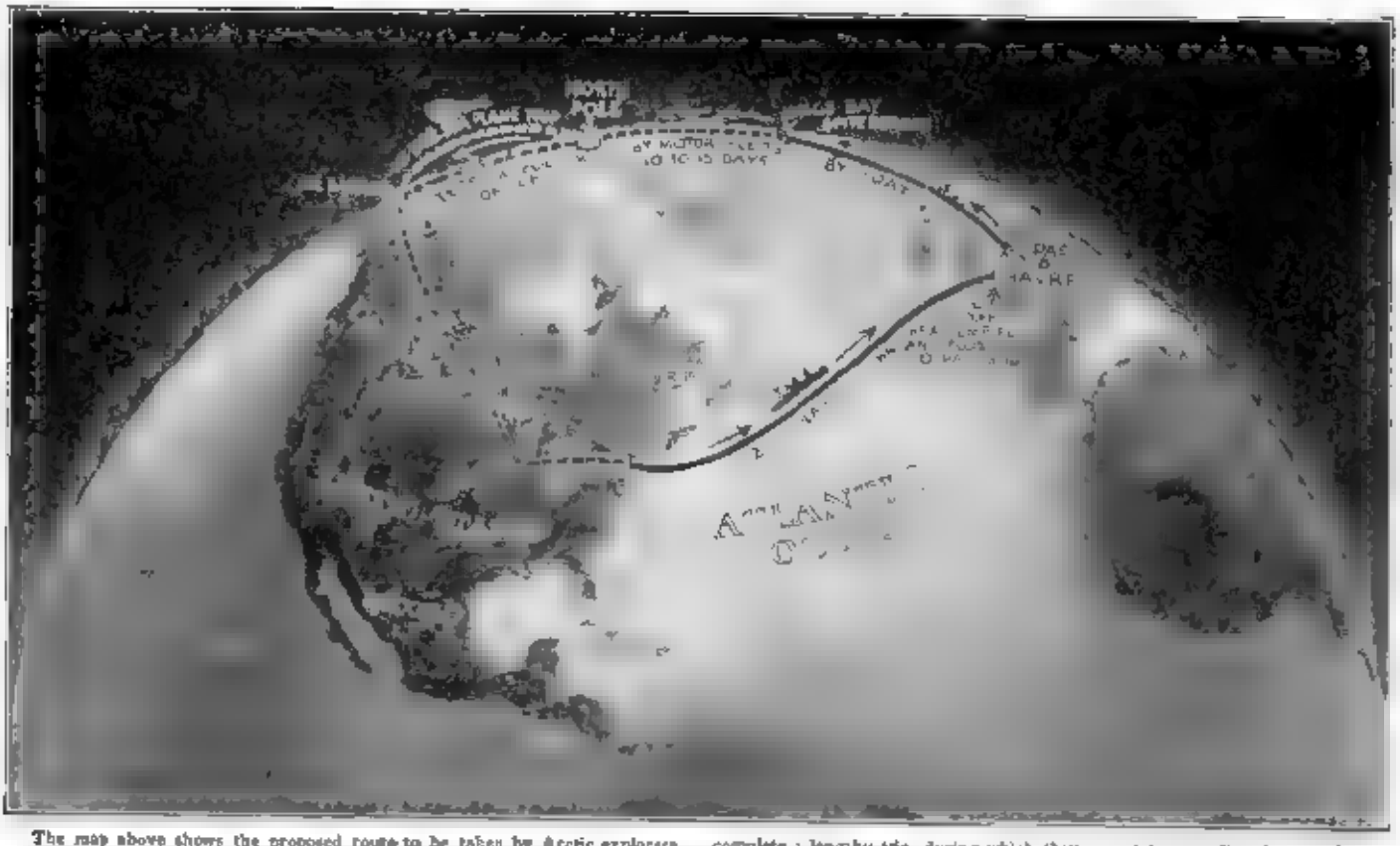
# Photo-Electric Cell Locates Fires

By J. KAY LONDON



At the right is a photograph of the new light sensitive cell and at the left and above are shown suggestions for a novel and unusual use for such cells. Strung between two points are adjustable locking cables and on these cables a small car operates, carrying a powerful searchlight. The car automatically travels from one end to the other of the cable as the operator travels at each end. It is operated on a lookout station of the type shown above and the photo-electric cell passes an even flow of current. If however the light beam is dimmed by passing through smoke an alarm is sounded at the lookout station.

*Photographs courtesy International Projector and Film Co.*



The map above shows the proposed route to be taken by Arctic explorers who will employ boats, specially designed motor sleds and airplanes to complete a lengthy trip, during which they expect to pass directly over the North Pole. The sleds to be used are described below.

# Motor Sleds to Explore North Pole

By J. KAY LONDON

A FRENCH expedition is planning to attempt to reach the North Pole next summer, and in order to accomplish their purpose, six specially designed auto-sledges are under construction. These vehicles will travel equally well on the surface of water or on ice and can change from one element to the other with hardly a pause. Our illustration at the bottom of this page shows the probable appearance of sleds of this nature equipped with caterpillar treads for traveling on ice and buoyant enough for water travel. The route that the party will follow is shown on the map at the top of this page.

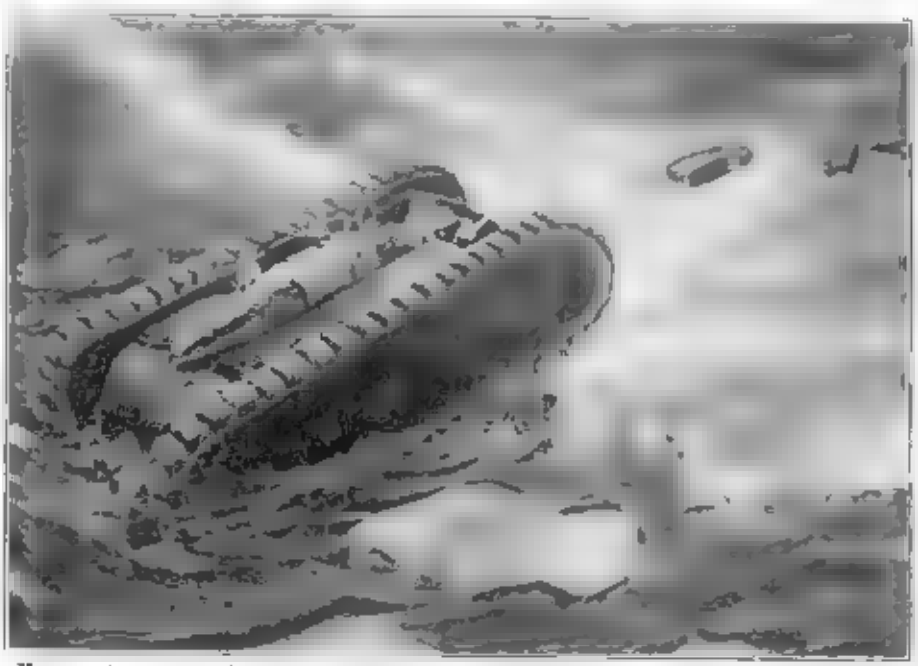
Naval Lieutenant Sales will head this expedition and the party will be composed of many well-known French scientists. Several of the larger scientific societies of France are financing the expedition, the cost of which is estimated at three million francs.

The party will be guided by Captain Otto Sverdrup, a Norwegian explorer who has won fame on several occasions by means of his intrepid journeys into the lands of perpetual ice. Captain Sverdrup is also the inventor of the amphibious ice sleds which it is said will travel over very rough ice at a speed of 12 to 16 miles an hour and will enter the waterway or climb from it to ice under their own power.

The novel part of this expedition is that the sleds, weighing 10 tons each, will be so equipped that they can carry dismantled seaplanes. With the latter it is proposed to fly from the North Pole to Cape Barrow after establishing a home camp at or near the pole. Two planes will be carried and the four remaining sea sleds will be employed for exploration purposes over the unknown region between Alaska and the North Pole. These sleds will eventually follow the airplanes to Cape Barrow.

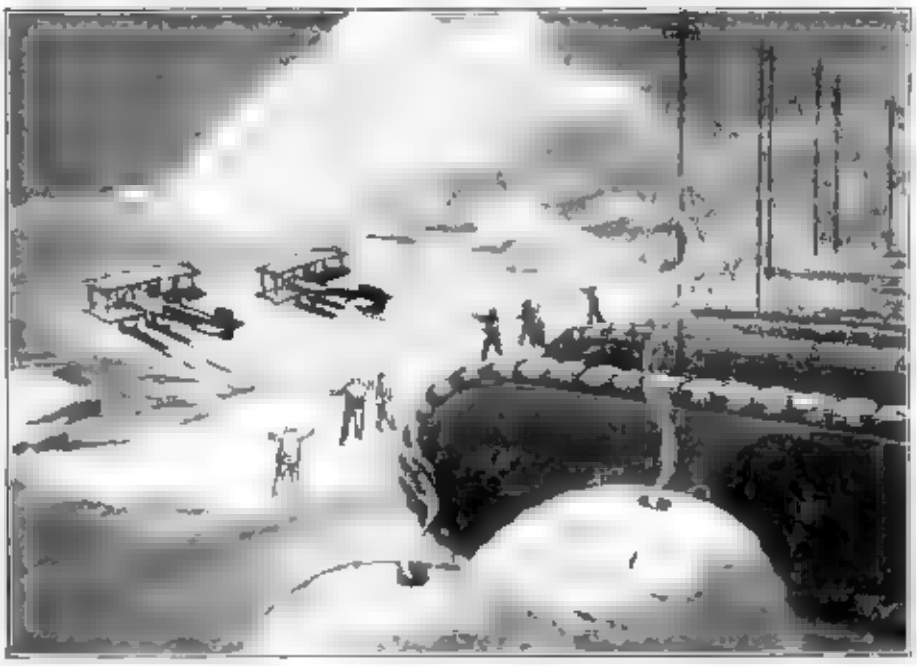
In the expedition there will be a total of 16 men. Ten of them will be specially trained in the handling of the new sledges while six of them will be expert airplane pilots. They will probably leave France about the end of April and will sail for King's Bay. From here the sleds are to be started and calculations show that the pole will be reached in from 10 to 15 days, barring unforeseen accidents. When the party reaches King's Bay they will of course wait for ideal weather conditions which will be reported to them via radio. By means of this communication system they can keep informed of the weather throughout the world and from this, suitable conclusions can be drawn. The start will then be made, proceeding direct to the pole as shown on our map.

Exploration will be carried on with the assistance of the amphibious ice sledges, all being radio equipped.



Here we show a view of the proposed motor sleds which will carry men, provisions and knock-down airplanes. The fuselage of one of the planes can be seen on the sled above.

The illustration at the right shows the departure of two large seaplanes from a base near the North Pole. Note the motor sleds equipped with radio and also the sleds for the personnel. The explorers are shown just starting off in their dash for Cape Barrow, Alaska.



Here we see the polar explorers ensconced in their exploration headquarters at or near the North Pole. The motor sleds equipped with radio are seen at the right of the illustration and the seaplanes are just starting off in their dash for Cape Barrow, Alaska.

One of the sleds that will be used is a light one-man affair and the others are so designed and constructed that it can be operated at high speeds. This will be used as a relief sled and for emergency purposes.

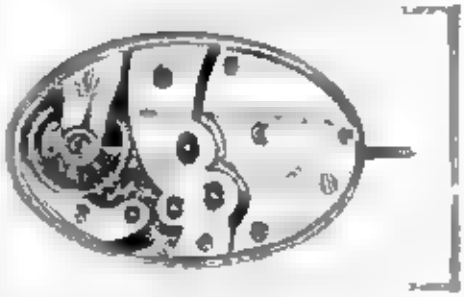
All of the work necessary to assemble the plans seems to point to the fact that the sleds will be ready to start around the pole in the early part of March. It is hoped that these explorers will reveal the secrets of the Arctic regions and possibly add to the knowledge of the world. After the explorations have been completed to the satisfaction of the party the sleds will proceed to cross the ice in the direction of Cape Barrow and will arrive there several months in advance of the seaplanes. The plans as we have them are very precise and equipped to spend the winter in the ice if it should so happen that such a course becomes necessary.

It may seem from this resumé of the essential facts that the plans are overly ambitious but much of the preparatory work has already been carried through and the one important point to be decided is the practicability of the motor sleds. They will be thoroughly and carefully tested several times before the expedition starts and it is said that many secret points used in the construction will enable them to perform seeming marvels. They will be propelled by gasoline engines.

# A Watch On Your Ring

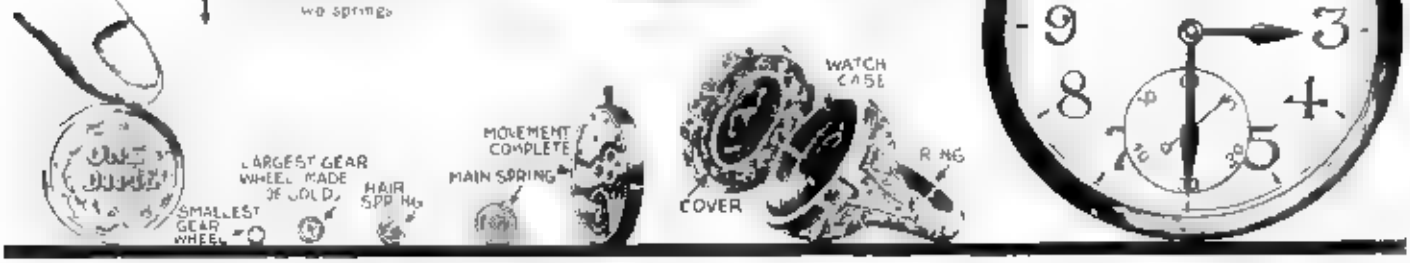
By SAMUEL BERNARD

Left: One of the smallest watches in the world is set into a finger ring and equipped with a cover in the center of which is set a precious stone surrounded by a series of small diamonds. This unique combination with the cover unhinged and partly open is shown in the photograph directly below. These ring watches are made in America now as well as abroad.

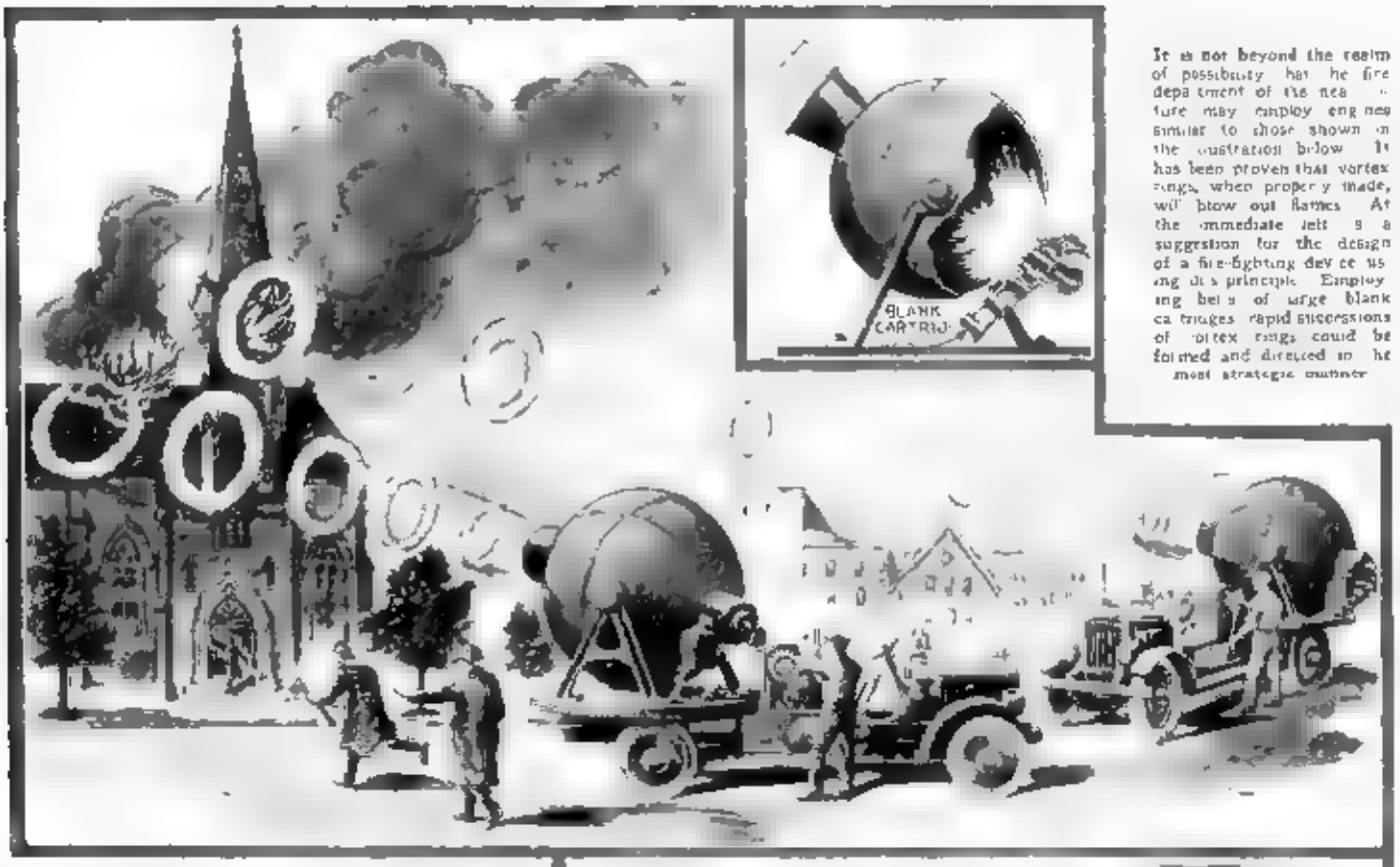


Above: A greatly enlarged view of the operating mechanism of the watch made for the last Empress of Brazil. Three years were consumed in making this watch at a cost of $25,000.

The illustrations below show the comparative sizes of some of the parts of this smallest watch, the complete movement and the size of the casing. At the extreme right is a standard size watch shown for comparison. The entire movement of this watch piece is only about the size of a dime in outside diameter and can be set in the lapel of a coat. The illustration of the complete movement are shown some of the gears and the two springs.



# Vortex Rings to Extinguish Fire




It is not beyond the realm of possibility that the fire department of the near future may employ engines similar to those shown in the illustration below. It has been proven that vortex rings, when properly made, will blow out flames. At the immediate left is a suggestion for the design of a fire-fighting device using this principle. Employing belts of large blank cartridges rapid successions of vortex rings could be formed and directed in the most strategic manner.

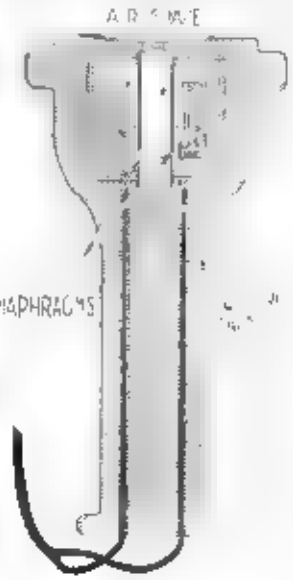
Experiments made in the offices of SCIENCE AND INVENTION Magazine proved that with a very small vortex ring generator employed as at the right, a candle flame could be extinguished at a distance of 28 feet from the source of the rings. This should suggest a series of interesting experiments to those who are interested in that direction. Use a comparatively large hole for the box with smoke so that the rings can be seen and then tap the end opposite the the hole. The result is shown.—J. Kay London.

# Novel Phone Receiver

This new telephone receiver is shown above in use in the standard manner while at the right it has been separated into its two component parts and is being used for listening with both ears. This extraneous noises are excluded.

EVER since the invention of the telephone and the beginning of its wide use in business and social life, it has been found to have many disadvantages in its usual form. Since then, hundreds of accessories for attachment to standard telephones have also improved in various degrees. Numerous such devices have been devised, but have not been particularly successful. It seems that the extraneous noises around a telephone user are about the most annoying that can be imagined and in order to eliminate this effect, one clever inventor has designed the separable receiver illustrated at the left. This instrument consists of two complete receivers connected together in the same general manner. When the parts are assembled the unit can be employed for use of either ear but by separating the two parts, the two sound reproducing elements can be applied so that people can listen with both ears. In this way and by its increased privacy and other one ear is not open to external sounds as is the case with an ordinary receiver is conserved. A mechanical design of this instrument is quite clever and the two parts are held together by means of a simple mortise joint. The connecting cords are so designed that when the receiver is used as a single unit they are out of the way, but the two halves can be separated an ample distance for application to both ears.

A newly designed telephone receiver is shown in the photographs and drawing in these columns. In appearance it somewhat resembles a standard type but in operation it has advantages over others.




*Courtesy Andak Co.*

# Non-Rolling Ship

Photos show appearance of ship equipped with bulges to prevent rolling even in heavy seas

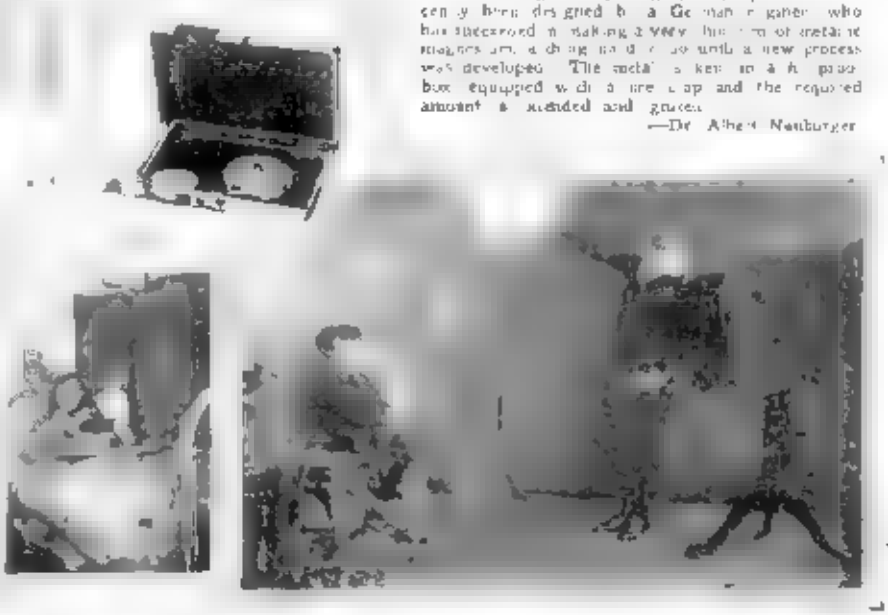
Above—A highly loaded ship equipped with the new bulges for the prevention of rolling and for increasing overall efficiency

The photograph immediately above gives an excellent idea of the size and placement of the anti-rolling bulges

# Photographic Flashlight

A new flashlight for photographic purposes has recently been designed by a German engineer who has succeeded in making a very fine form of metallic magnesium powder with which a new process was developed. The metal is kept in a hopper box equipped with a screw cap and the required amount is expended and graded.

—Dr. Albert Neuburger



# The Light-Beam Piano

*Light and Sound Are Made to Play Strange Tricks and Salt Crystals Reproduce from Phonograph Records*

**By A. P. PECK**

The illustration at the right and on the cover of this issue shows our artist's conception of what the "light beam piano" may look like when it has been reduced to a practical commercial form. In the type shown several selenium cells are employed although it may be that this number will be reduced. There are also several loud speakers used in connection with this piano so that high, low and medium notes can be reproduced with the greatest fidelity. A vacuum tube amplifier [illegible] possible

I [illegible] anticipation that we scanned the flying scenery of Long Island from our comfortable seat in the smoker and looked forward to our arrival at Mill Neck, the nearest railroad station to the Batterman estate, where H. Grindell Matthews, the inventor of the so-called "death ray," has been conducting numerous experiments with unusual and most interesting instruments. Arriving at our destination, a car whirled us through the countryside and in a very few moments we were shaking hands with H. Grindell Matthews and [illegible] right-hand assistant [illegible] a little casual conversation [illegible] across the lawn to a small, low building, behind the closed doors of which Mr Matthews and Mr Lines have been constantly at work for some time past. Entering, we found ourselves in the presence of one of the finest and neatest arrays of instruments that it has ever been our privilege to examine. Most [illegible] looking display was a table upon which was mounted what we later came to know as a *Luminaphone*. This device is so made and its parts are so arranged that by means of a controlled beam, or rather, beams of light tones comparing most favorably with the finest of pipe organs can be produced. The apparatus necessary for doing this even on a large scale will take up very much less room than a standard pipe organ and, furthermore, has several advantages over that instrument. It is not affected by various atmospheric conditions and once tuned is always tuned. Dust has very little effect upon its operation, whereas quite the contrary is true of an ordinary pipe organ.

### THE LUMINAPHONE

This queer-looking arrangement resembles a cross between two perforated steel mushrooms and four hairdressers' appliances designed for creating a permanent wave. The mushroom-like arrangements are nothing more or less than curved discs of steel mounted on spindles and so arranged as to be rotatable at a constant speed of 400 revolutions per minute. The surfaces are perforated with regular rows of holes, some of them spaced a little further apart or a little closer together than others. A very good idea of the appearance of this instrument can be obtained from the photographs and line drawings given on the opposite page. The parts of this instrument that reminded us of a hairdressing parlor were merely several series of small lamp housings, all of which were arranged in a definite sequence and tilted at a certain predetermined angle. The purpose of this arrangement can be seen from the later description.

In this working model, a small keyboard was mounted on one table directly in front of the whirling discs and every key on that board was a switch which would close and open a circuit when pressed and released. And then, besides the whirling discs, the lamps and the keyboard, there was a standard audio frequency amplifier of the resistance coupled type such as that familiar to all radio enthusiasts, and connected to the output of this amplifier was a loud speaker of conventional design and make.

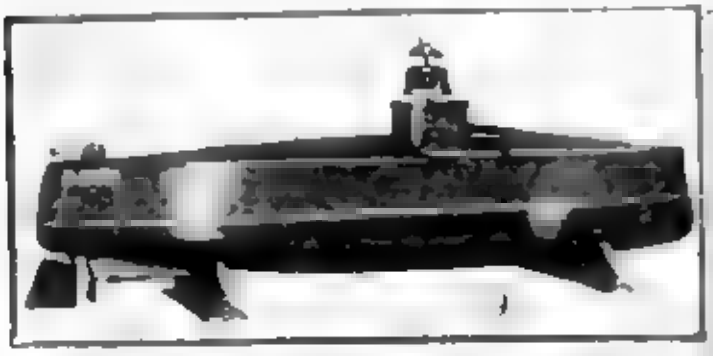
### MODE OF OPERATION

Before discussing the mode of operation of this musical instrument, let us harken back to the days when we studied physics in college or high school. One of the usual [illegible] is a steel disc mounted upon a spindle and equipped with a handle by means of which the disc can be rotated rapidly. The surface of the disc is perforated much in the same way as the disc shown in our illustrations and by rotating the disc and directing a current of air from a tube onto one of the rows of holes, a musical note could be produced. By blowing the air against a different row of holes, another note could be [illegible] breaking up of the column of air at regular and definite intervals by the disc. Something very much on this same order happens in the *Luminaphone*. Beams of light are directed upon the surface of the disc and when this beam is in line with a hole, the light passes through, but when in line with the solid surface of the disc, the light is cut off. Directly below the holes, and so placed that all of the lamps above it are focused directly upon its surface, is a light sensitive or selenium cell. This cell receives a series of impulses of light and operating through a vacuum tube which acts as a relay and a series of vacuum tubes which act as amplifiers, it produces variations of an electrical current which correspond exactly to the frequency of the light pulsations impressed upon the surface of the cell. The varying electrical currents are after being amplified, fed into a standard loud speaker and reproduce a note equivalent in frequency to the number of times per second that the light was interrupted by the revolving steel disc. Thus it can be seen that the tone or tones produced by this instrument are directly dependent upon the positions of the perforations on the surface of the revolving discs and upon the speed of revolution as well as upon the number of lamps which are lighted at any one particular moment. The exact action of this novel musical instrument which Mr Matthews hopes will replace pipe organs to a very great extent can be seen by studying Figs. 1, 2, 3, 4 and 5 on the opposite page. It will be noted that the various lamps are controlled by the keys on the keyboard, there being one key for each lamp. The number of lamps and keys can be increased to include practically any number of notes that are desired.

### NEW PHONOGRAPH REPRODUCER

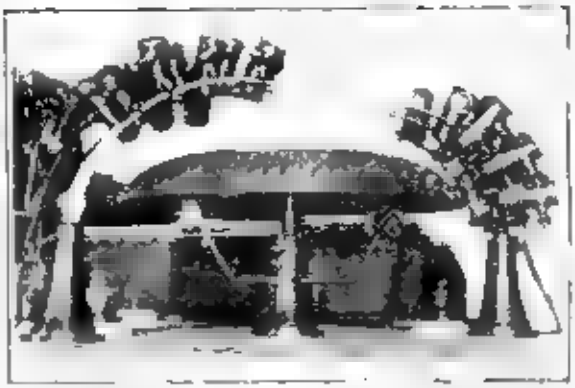
After studying the *Luminaphone* carefully and watching it in operation, we next viewed a piece of interesting apparatus reposing on

(Continued on page 959)

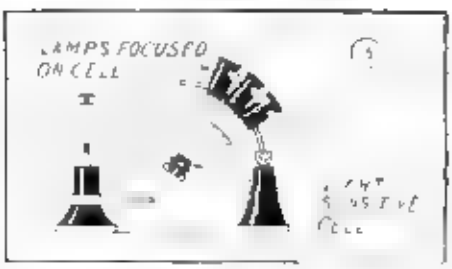


Above: A view of the light-controlled boat invented by H. Grindell Matthews. The line drawing at the right gives a very simplified view of the apparatus used in a boat of this nature and also indicates the way in which the various [illegible]

The photo at the left shows H. Grindell Matthews at the keyboard of the original model of the Luminaphone, his latest invention. This device uses light rays focused upon a selenium cell to produce musical tones. The light rays are interrupted in order to give this effect by perforated steel disks providing the necessary shutting medium. They are mounted on spindles and rotated in synchronism with each other. On the opposite page will be found a complete description of the operation.

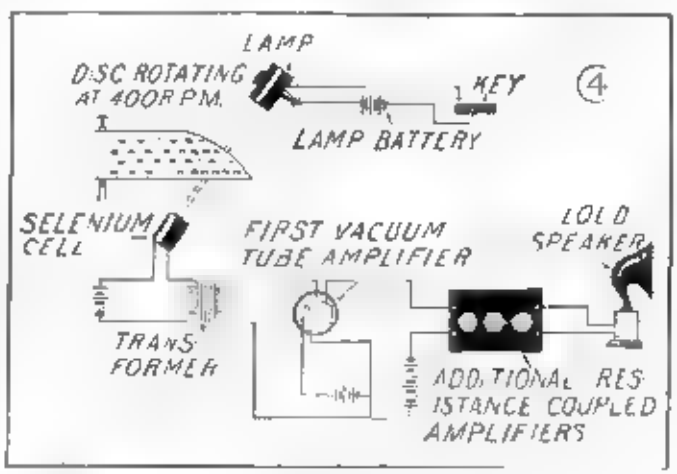


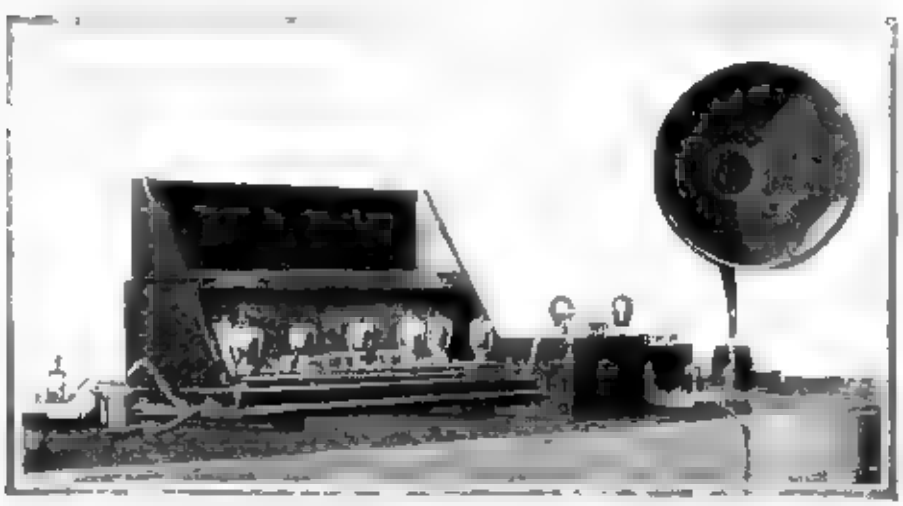
The photo above shows a close-up view of one of the rotating disks of the Luminaphone. Note the two light-sensitive selenium cells mounted on the ends of an arm and aimed directly under the rotating disk.




The drawing above shows how a series of lamps are focused through the rotating steel disk on the surface of the selenium cell. By using this system of arranging the lamps, a comparatively small number of photo-sensitive cells are employed, yet a wide variety of the musical tones is obtained. The variations in strength of the pulsations of light reaching the surface of the cell produce different notes and harmonics which are then amplified and rendered audible.

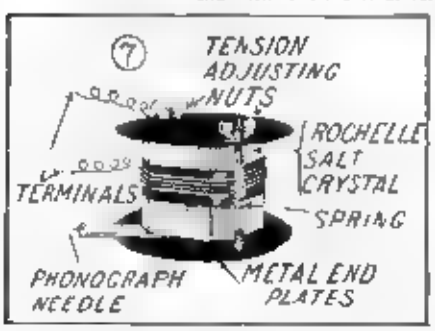
The drawing at the right shows the essential details regarding the operation of the Luminaphone. A lamp, controlled by a key and lighted by a local battery, is flashed on and off. It is focused on the selenium cell and the light from it is interrupted periodically by means of the rotating perforated steel disk. Pulsations are set up in the selenium cell and are then passed through a cascade vacuum tube amplifier. The loud speaker reproduces the vibrations in audible form. The result is a note or tone of a pure musical quality. Tones of any pitch can be produced with a most wonderful effect.



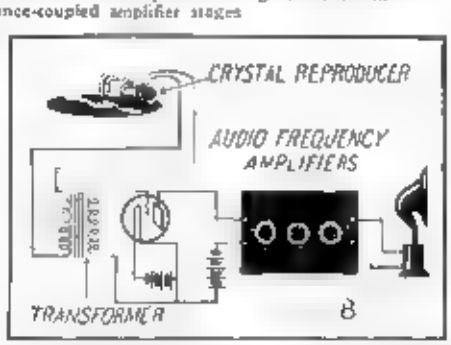



The amplifier used in connection with the Luminaphone in its experimental stage is of typical British design and is illustrated in the photograph above. The input is through a transformer and then follow several resistance-coupled amplifier stages.

The photograph directly below shows the appearance of a standard talking machine equipped with the new type of crystal reproducer developed into a commercially practical form by H. Grindell Matthews. The fundamental theory of this type of reproducer is not at all new as is mentioned in our article, but the fact remains that Mr. Matthews has made one of the first ones to appear in the commercial field, a competitor to the usual type of mechanical or electrical reproducer. This device was heard in operation by the writer and it rendered the best reproduction of a phonograph record that he had ever heard. Tremendous volume was made possible by amplifying the A.C. generated by the crystal. Using resistance-coupled amplifiers, no distortion was detected.



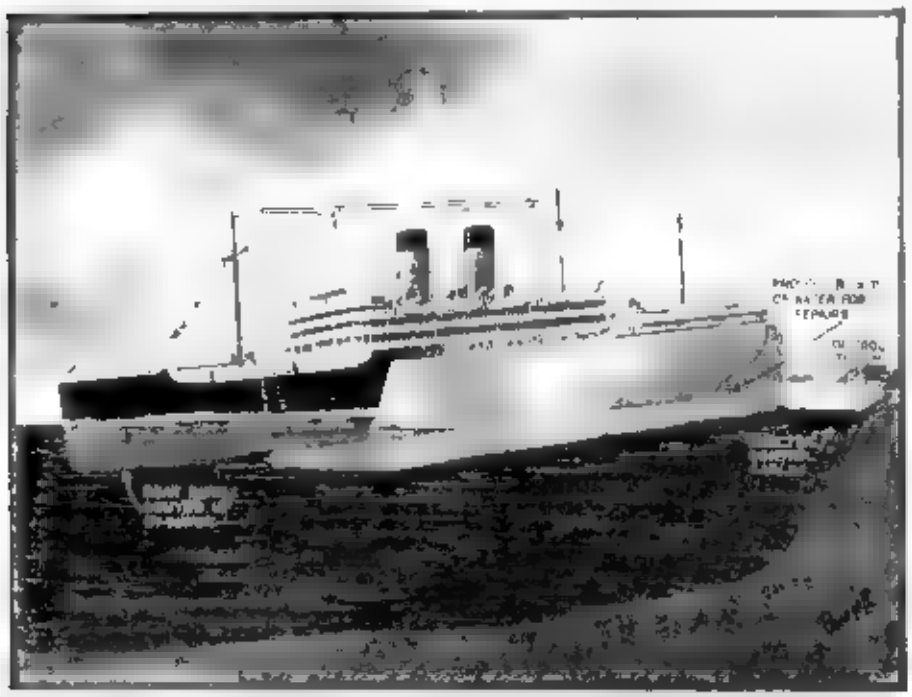

Above we show the principle piezo-electricity underlying the crystal reproducer for phonographs. The torsion effects set up in the crystal generate an alternating current of varying intensity which can be amplified and reproduced.




The above diagram shows how the crystal reproducer is connected to an amplifier. Note that no local battery is employed in the crystal circuit inasmuch as the crystal itself is an A.C. (alternating current) generator.

# How Floating Drydocks Operate

FLOATING drydocks are not very well known to the general public and the information given herewith was obtained in a recent interview with Mr William T. Donnelly of New York City, well-known builder and designer of these remarkable pieces of marine architecture. A floating drydock is used in preference to a solid basin, because it may be moved from place to place whenever so desired, and because it possesses a number of operating features not obtainable with a solid basin or shore type of drydock. Just to cite one instance of the versatility of the floating type of drydock, imagine for a moment that you were faced with the problem of making repairs on a ship which weighed 28,000 tons and that you only possessed for the purpose a drydock having a capacity of 20,000 tons. How would you raise this boat out of the water if you had to overhaul the propellers and rudder? It can be done with a floating drydock as will be explained anon.



When it is necessary to make repairs on the propeller or rudder of a large vessel, it is not necessary to lift the whole boat. Only part of it need be out of the water as shown. Fig. 3.

The sectional drawing, Fig. 1, A, B and C shows how a floating drydock is submerged by filling its compartments with water, so that the inner floor surface is lower than the keel of the boat to be drydocked. When the drydock has been sunk lower than the keel of the boat, the boat is warped into the drydock by tugs or else by winches and cables, but rarely under its own power as it creates too much commotion in the water.

When the vessel has been floated into the drydock, the orders are given to start pumping the water out of the buoyancy chambers and it gradually rises. The huge blocks which come up under either side of the vessel are manipulated from above by means of cables and suitable control gear. The intermediate and final stages of raising the ship with a floating drydock are shown at Figs. 1-B and C.

In the illustration at Fig. 2, the general arrangement of a typical floating drydock is shown. The drydock is held flexibly, yet firmly, in position near the shore in most cases, which enables the pump motors for emptying and filling the various buoyancy chambers to be operated by electric power carried by cables from the shore control station. The chief operator in control of the drydock during its lifting and other operations, is located in a building which overlooks the top of the drydock and from which he can, with a pair of binoculars, see all of the motor pump speed indicators at any instant. In front of him are a series of electrical controllers by which the speed of any of the buoyancy compartment motors can be regulated. If he so desires, there is a master controller whereby he can cause, at the throw of a switch handle, all of the pump motors to work in unison.

The illustration at Fig. 3 shows how a vessel longer and heavier than can be handled by the drydock ordinarily may be partly lifted from the water, so that repairs can be carried out on the damaged part, in this case the propellers and rudder. One of the greatest games in the world is that of handling a floating drydock, for the chief operator or engineer in charge can, by a slight miscalculation, cause the drydock to tilt up at one end and throw the boat outward, which would be likely to severely damage the hull, and if the boat should sink, a pretty expense would be involved in raising the sunken vessel before it could be temporarily repaired and drydocked. A naval engineer once had a large vessel in one of these floating drydocks, and after giving an order his hair almost turned white in one minute when he saw the drydock quickly take a slanting position, with one end considerably higher than the other, which almost threw the boat out of one of the ends.

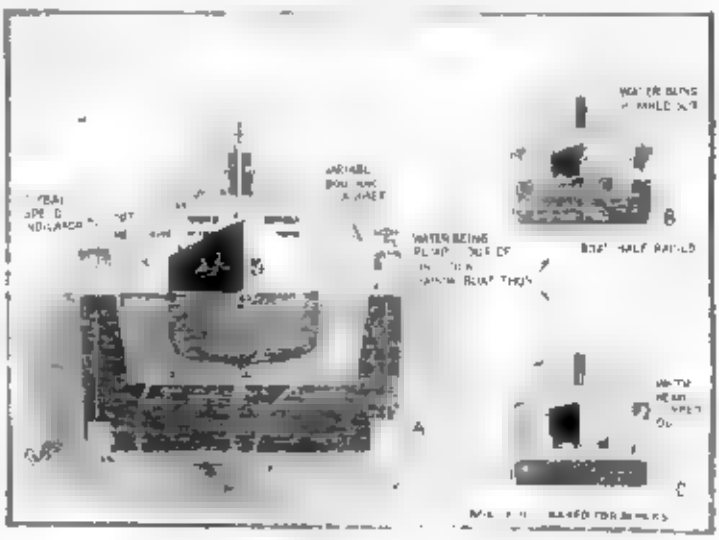
One peculiar thing about these floating drydocks, which are divided off into many separate compartments, each of which can have the water pumped out individually when desired, in order to increase the buoyancy, is that they are more sensitive in a lengthwise direction than they are crosswise.

In the illustrations the struts shown between the deck line of the vessel and the sides of the floating drydock are not heavy beams to help hold the vessel steady as it rises with the drydock, but are simply measuring rods used to ascertain when the vessel is centered, in its position on the drydock.

The art of operating drydocks, and it is an art, is not the commonplace and mediocre subject one might think it to be offhand. On the contrary, as the case and it only needs a perusal of the following paragraphs in this article and a study of our illustrations to show this to be entirely true. Students of this subject will find much of interest.

Some of the most interesting engineering problems one could find are encountered in the drydock game, as Mr. Donnelly pointed out. If you want to consider a real engineering problem, that shown in Fig. 4, which illustrates a proposition this engineer had to contend with in short order, should prove interesting. A large steam derrick, as well as a huge caisson, had to be raised with a floating drydock, and the only way to tackle this problem correctly was to ascertain the center of gravity of each of these two heavy weights, the total of which was near the maximum lifting capacity of the drydock. How would you go about such a problem? Here is the way it was solved and the two heavy structures lifted successfully with the floating drydock. Blueprints of the steam derrick and the caisson were obtained from the Navy Yard engineers involved in this case, and the various masses and weights of each part of the structures were carefully checked up and the center of gravity of each structure determined. Once these true centers of gravity of the two masses totaling about fifteen to twenty thousand

The three drawings at the right illustrate the working of a drydock. First the dock itself is sunk by filling it with water. Then the ship is maneuvered into the dock and electric pumps are started in operation. Thus the water is removed from the dock till the boat assumes the position shown at B and finally is fully out of water as at C.
Fig. 1

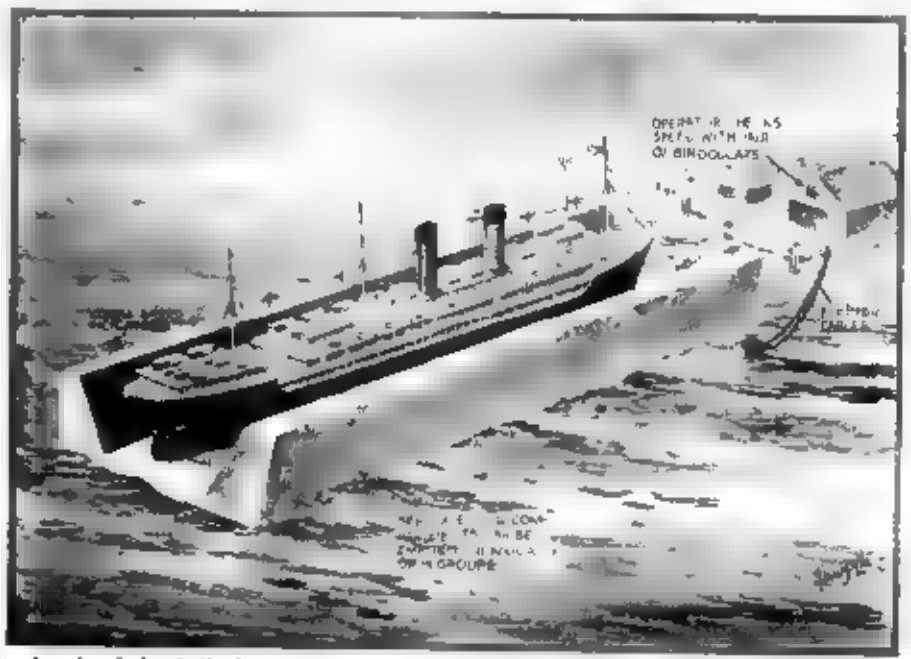


tions, was known, the engineer in charge could specify where each should be placed. The submerged drydock before starting pump out the water so as to increase the [illegible] calculations came out as he expected and the caisson as well as the steam derrick were successfully [illegible]

While all sorts of improvements have been introduced in the construction and operation of drydocks, they present a peculiarly good opportunity for utilizing electric power. There are some interesting features in the operation of these structures which are especially noticeable in the smaller ones. To prevent the ship from overturning when she rises out of the water, what are known as bilge blocks are used. These slide back and forth at right angles to the keel on the floor on runways on the floor of the dock. They are built up according to the shape of the ship and are made up of very large square pieces of timber or blocks of wood, as they may be called, placed one on top of the other and held in place with what the shipbuilder calls dogs, a sort of heavy iron staple which is driven in with a maul, one end in each of two adjoining blocks. These blocks may be three feet and more in length and with a minimum of about twelve inches square and may be much larger. They may be built up to four or five feet in height or more. It is evident that they will be very heavy. They are held in place by a sort of slide, so that they can neither rise or descend, but can move laterally. In the dock with no water in it it takes very great force to slide these heavy blocks along their runway on smooth runway. But they are never moved except for some especial reason or else when there is water in the dock. When the dock is filled with water, which means that it is a floating dock that it has been sunk to a proper level the wooden blocks are floated up by the water so that they hardly press against their runway at all, perhaps even against the holding-down strip, a part of the groove which prevents their rising. Thus floated, they move so easily that a man at the end of a rope can slide them in against the ship's bilge. As they are drawn in they jump against the vessel with a sort of thump and that indicates that they are "home" and the ship is resting with the blocks support ing it securely preventing from overturning as the water leaves it.

To paint the bottom of the ship, of course, requires it to be out of the water. The bilge blocks cannot be moved back until the dock is filled with water. In the painting of a bottom of a ship there are small areas covered by the bilge blocks that have to go unpainted; so that when a ship leaves a dock she has on the bottom a number of unpainted bits about a foot square which are designated as "holiday spots."

One of the greatest propositions in the




**A series of electrically driven motor-pumps drive the water from the drydock and their speed is controlled from land. Flyball speed indicators are positioned as shown. (Fig. 2.)**

direct on of drydocks was to have one which could be moved upon rails like a gigantic railroad car. The ship was to be floated into it, secured in position, then the ship and dock when water was withdrawn, were to be transported across the land. This was suggested with the view of crossing the American Isthmus. To pose the ship in the drydock instead of the small primitive bilge blocks, it was proposed to have a set of hydraulic rams, whose ends would be against the ship and the water was to be pumped into all the rams from the one source so that every ram would be pressed against the side of the ship with identical pressure per square inch of its area and held there immovable. Nothing can pose a ship so exactly and with greater mathematical precision than the water in which it floats. But it is probable that no one ever gave very serious thought to the idea of carrying a drydock full of water across the country.

Instead of drydocks, marine railroads are often used for smaller vessels. The ship is floated over a cradle with its own bilge blocks drawn up as already described, and rises out of the water upon dry land for painting or repairs. The cradle and ship are carried on an inclined railroad. It will be seen that the marine railroad which has been in use for many generations suggested the idea of transporting ships across the isthmus between the two Americas. The hydraulic rams operated from one source of pressure

The principal original feature which [illegible] applicable to present-day drydocks. In operating any such system each ram should be provided with a valve on the inlet so that once it is solidly pressed against the side of the ship the closing of the valve will make it absolutely fixed.

A difficult engineering problem was recently solved as described in the text and illustrated at the left. A derrick and a caisson had to be raised in a floating drydock and by altering the centers of gravity G1 and G2 this was accomplished successfully (Fig. 4.)

# Offers a Safety Device

SUBMARINES could be made as safe as surface boats but for the indifference of the Navy Department to safeguarding the lives of the crews, said Anthony J. Griffin, representative from the Twenty-second New York City District, in an interview recently.

"It is ridiculous to talk of doing away with submarines as instruments of war," he said, "although they should unquestionably be made safer by the adoption of every possible device to avoid tragedies like those of recent months. The Navy Department has shown an extraordinary lack of foresight in its failure to install the simplest means to protect the lives of the submarine crews.

Mr. Griffin told of an invention of his patented in 1914, which, he said, would provide means of escape from a flooded submarine. The device consists of a series of buoyant safety chambers, placed between the hull and the super-structure of the submarines, which may be entered from below and floated to the surface by means of a releasing apparatus within the chamber. These chambers, said Congressman Griffin, may be of any size or number and can be so placed as not to affect in any way the lines of the boat.

Mr. Griffin also pointed out that the installation of rings on submarines would facilitate the raising of the boats by grappling hooks and obviate the delay and difficulty involved in raising them with chains wrapped around the entire hull.

The Griffin safety chambers would represent the parachutes carried on airplanes, and whose absence had much to do with the loss of life on the *S-4*, it is thought.

March

RADIO PHONE WRNY STATION

25 Cents

# Science and Invention

With which is combined

## The EXPERIMENTER

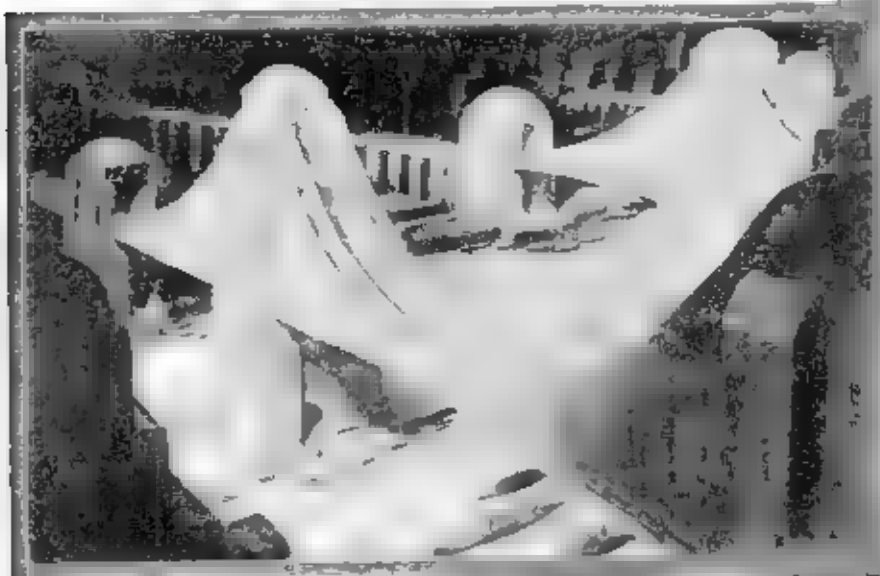
THE
RADIO GOLD EXPLORER

See page 992

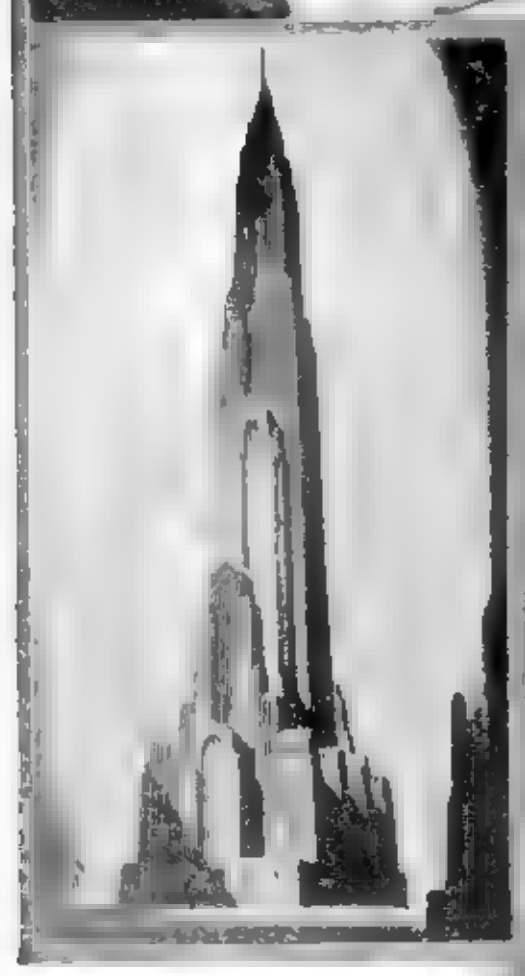
40 NON-TECHNICAL RADIO ARTICLES

# Architecture of the Future

The illustrations on this page are reproductions of paintings made for the tercentenary anniversary of New York City and exhibited at John Wanamaker's. The one below shows a possible construction of bridges of the future on the columns of which offices and apartments are located. This is made possible by the extreme width and height of these supports

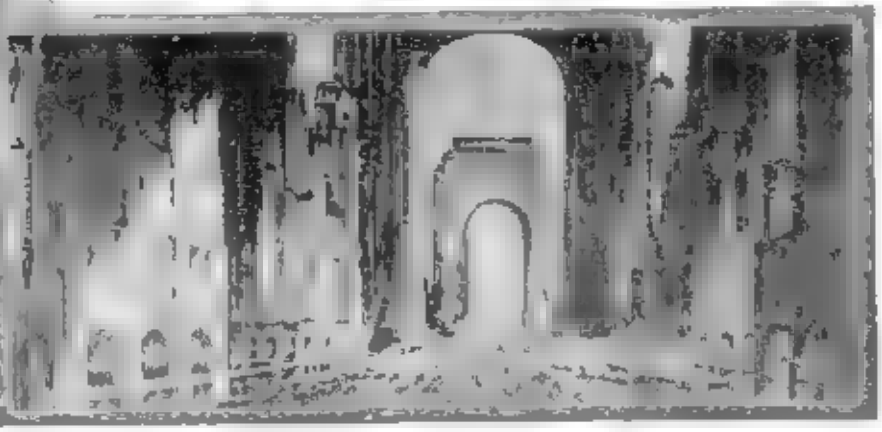


Above—Looking upward from a street surrounded by buildings such as some of the present-day artists believe will constitute the architecture of the future. Note the unusual constructional details of the various edifices and the large type of aircraft above them. If this is a design of the latter than are craft seen in the center of the picture. Will any of the present generation live to see sights such as these depicted?



Above—A view to be met with in a city of the future. Even our present-day skyscrapers will be dwarfed by the magnificence and enormous size of surrounding buildings. Note the Hudson River bridge and the central distributing station of atomic power from which aircraft and other motive units obtain their power for propulsion

Below—Looking down a street of the future. The sidewalks are elevated and protected and the streets are wide enough for motor traffic and every available space is put to use. Air travel of the future is touched upon in this illustration by showing a series of airplanes in flight above the skyscrapers in the background.



An architect of the present day has designed a skyscraper that could be built by following the present zoning laws. An artist's conception of this design is shown in the drawing above directly above. Note the method of terracing the various heights so that the building will be mechanically strong and able to withstand the stresses to which it may be subjected

# The Radio

## Also Containing a Summary

By JOSEPH H.

Fig. The above diagram gives the circuit of the radio gold exploring device and shows particularly the receiving part of the apparatus. It will be noted that this is a short wave receiver using the parabolic radio wave reflector as an antenna and a metal shield on the box as a counterpoise.

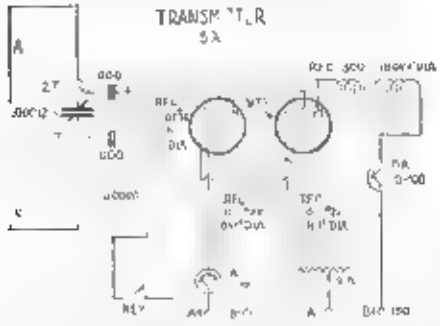



Fig. 2. The diagram of the five meter transmitter a part of this radio ore locator is given above. A indicates the antenna and C the counterpoise. The transmitted beam is reflected by ore bodies and picked up at the receiver.

THE quest for hidden gold has caused the expenditure of countless fortunes. All sorts of contrivances and devices have been used. Recently absolutely fraudulent systems have come with success [illegible] on the one hand even the scientific ore locators have produced no material results. The difficulty with most scientific gold explorers and locators is that so much time is required in plowing a certain area and removing all possible chance of error. This difficulty is particularly apparent in the Eotvos balance illustrated in Fig. 3. This balance is quite heavy, difficult to transport and its operations are completely shielded by metal shields. The balance is extremely sensitive, however, and consequently must be secured and adjusted in place before measurements

Fig. 3. The above illustration shows the method of using the Eotvos Torsion Balance. This was designed by Baron Roland von Eotvos of Budapest. It is placed near to the edge of a supposed mineral ore area, and due to difference in gravitational pull, indicates the presence of these bodies beneath the surface of the earth.

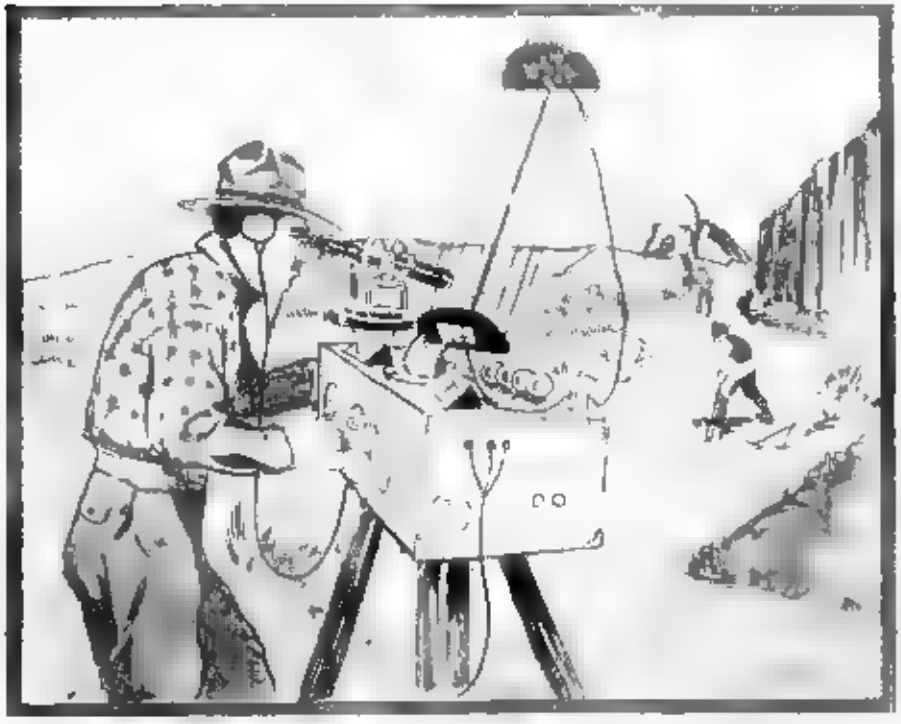


Fig. 4. The above illustration shows the radio gold explorer in operation. The directive radio beam being sent out from the apparatus in the distance, which at the present time is being used as the transmitting end, is picked up at the set in the foreground. The beam from the transmitter is reflected by subterranean ore bodies or chests of gold. By means of the surveying instruments the exact position of the hidden treasure can be pointed out and attempts to secure it can easily be made.

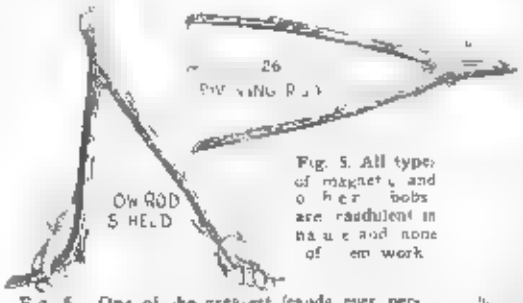



Fig. 5. All types of magnetic and other bobs are fraudulent in that use and none of them work.

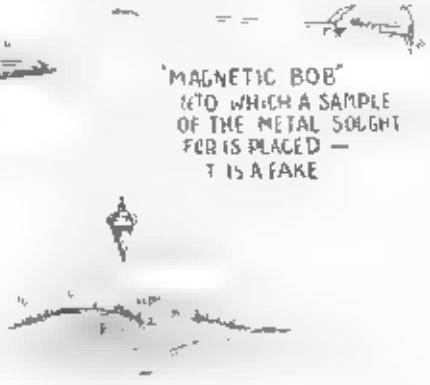



Fig. 6. One of the greatest frauds ever perpetrated is the "divining rod." The diagram above illustrates how a divining rod is held. The one in the center shows the actual dimensions of a twig to be used for this purpose. Hazel wood is generally used.

are made. Should the balance center itself over a vein of ore, it would give no reading, unless it is placed at the edge of such a vein, the gravitational pull upon one arm of the balance would be greater than that upon the other, and consequently the balance would give a reading. By moving the balance, the area of the ore body can then be determined.

A really scientific ore locator is the one employing the principle of reflection of radio waves by subterranean metals. It has long been known that a radio wave is reflected by any metallic body the same as a light ray is reflected by means of a mirror. If a very directive radio beam is sent out, and the submerged body offers a metallic vertical surface such as a casket of gold would furnish, or as a flat vein of ore might be expected to produce, the radio beam is again reflected, after it penetrates beneath the soil to the surface of the ore and is picked up by the receiver. It is now a simple matter to read off the inclination of the parabolic reflector at both the transmitting and receiving ends. Then set the surveying instruments [illegible] point of intersection would be the location of the [illegible]. In view of the fact that short waves do not penetrate the soil to a very great extent [illegible]

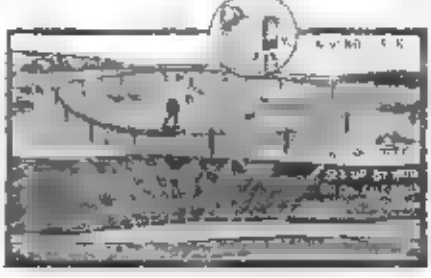


Fig. 7. Mansfield's oil and water locator operates on the principle of electrical currents being set up by flowing water from which the magnetic lines of force pass upward and cut the earth coil, indicating a current which affects the galvanometer.

# Gold Explorer

## of Ore Locating Methods

**KRAUSE**

poss ble in this way to limit all surveying to the discoveries of metals within easy reach. The circuit diagrams for both the receiving and transmitting end of this particular device are shown in Figs. 1 and 2.

For a great many years faith has been placed in such devices as the divining rod or the magnetic bob or other bobs swinging freely from a pendulum containing as some inventors claim such substances as radium or radium salts. The latter device is indicated in Fig. 5, but it may take on any other form, for instance, the device may be a vial suspended from a string, or it may be a ball suspended from a string. The stick itself

Fig. 1. Veins of ore have been located by means of the earth conduction system. Illustrated above [illegible] the resistance of the earth would change if there were a conducting vein of ore somewhere between the two copper electrodes driven into the earth. A mineral spring would also change the earth's resistance.

is not a requirement. The inventors of these devices claim that if a piece of gold is put into the vial or into the bob, that the bob will sway back and forth pointing in the direction where the body of gold has been buried, and when the bob is directly over the treasure, it is reported to assume a circular motion, as Fig. 5 indicates. These devices are all fakes, they never did work and they never will. In order to induce a purchaser to buy a device of this nature he frequently permitted to manipulate the apparatus himself. A coin or some other piece of metal is hidden from view and the prospector is then instructed to use the device to locate it. The subconscious action on the part of the user makes the bob sway as he is told it would sway and when he is at or near the position of the concealed object the bob takes on a circular motion [illegible]

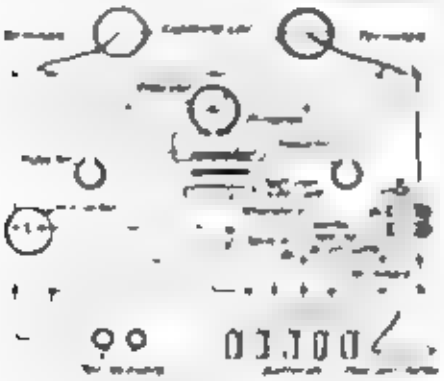


Fig. 2. The diagram above shows an elaboration upon the Hughes induction balance. This particular balance and all it's details was described in the August 1921 issue of SCIENCE AND INVENTION Magazine. A small laboratory instrument for demonstrating how the Hughes induction balance works is shown at the extreme right of this page.

Fig. 10. The diagram at the right shows the circuit of the Hughes induction balance as built for laboratory purposes. A buzzer is caused to make and break the circuit in the inducing coils. The pick up coils are connected in series with a receiver and when balanced no sound is produced. When a metal body is held near one of them, the receiver buzzes loudly.

is concealed and he does not know its whereabouts, it will be impossible for him to find it. The same is true of the divining rod in Fig. 6, and farmers all over the country will relate how that waters and metals have been located by aid of the divining rod with an uncanny degree of accuracy. In many cases however, water is found closer to the surface than at those parts where the divining rod dipped downward. The slightest movement on the part of the operator will cause the stick to bend toward the earth. It is always held in a very unstable position. When once the rod starts to move, the operator attempts to hold it back. In doing so he further bends the ends of the hazel twig which he holds and causes the rod to move downward still more violently. If the operator were to be blindfolded and made to go [illegible] the rod would never point [illegible] spot twice in succession.

A [illegible] is used in Fig. 7. This depends upon the fact that subterranean waters generally [illegible] lines of force in the surrounding soil. These lines of force passing through the soil cut a coil of wire placed at the surface, and in so doing induce current in the wire coil. This current affects a sensitive galvanometer and in this way determines the location of bodies of water or ore.

Large veins of ore may be located by the method of determining the electrical resistance of the earth between two points at a definite known distance apart. If one thousand feet of soil in the immediate area where

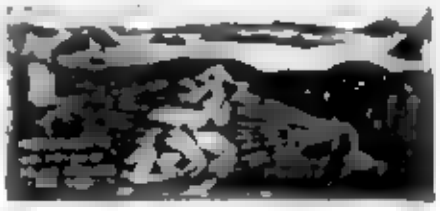


Fig. 4. The Fessenden ore locator works on the principle of changes in intensity of sound [illegible] reflects the sound waves, and for this reason one sound producer and three sound receiving wells are employed. Each sound receiving well is equipped with an oscillograph to record the sound picked up.

the prospecting is to be done has a resistance of let us say ten thousand ohms, and [illegible] and we find we strike one certain position of the stakes where the resistance suddenly drops to five hundred ohms or even less, it is reasonably safe to assume that the soil contains some particular substance which makes it more conductive and which may be either mineral salts (springs) or metals. This method is illustrated in Fig. 8.

The Hughes induction balance shown in Figs. 9, 10 and 4 is of course a well-known device and is frequently used for demonstrative purposes in the laboratories. This balance opens a great field of possibilities and it is surprising to note what little experimental work has been done upon the original idea. Essentially the device consists of four coils wound with bell or other wire and so mounted that the fields of force in one pair

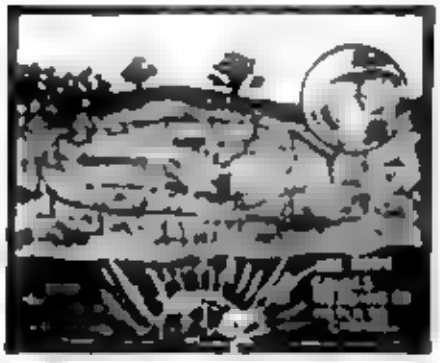
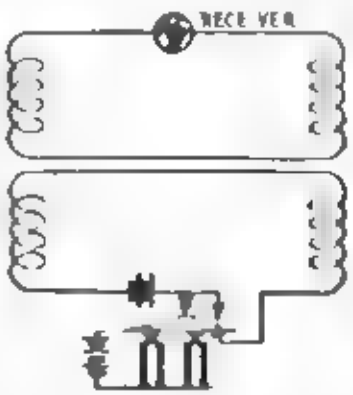


Fig. 13. This illustration is intended to show the principle of the Fessenden ore locator illustrated in Fig. 11. Four wells are generally sunk at the four corners of a five mile square. Each [illegible] surface oscillograph. One of them also contains an engine-driven high frequency alternator. The sound waves transmitted through the earth are picked up by the oscillographs and the deflective waves, due to the location of ore body, are likewise recorded. In this way the positions of the ore bodies may be definitely determined.

In Fig. 12 the principle upon which the device operates is dependent upon a large inducing coil affecting the subterranean body of ore, and the pick up coil locating the point of maximum reflection. Fig. 13 is of value only for magnetic ores.



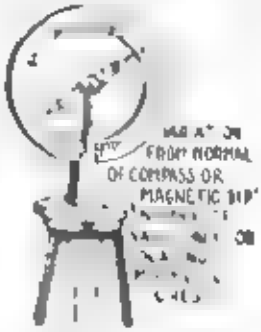




Fig. 12. [illegible] for detecting [illegible] of concealed metals is illustrated in the diagram above. A large coil is placed near the [illegible] current from an alternating current generator passed through the turns of this coil, and if a subterranean body of ore is under the exploring coil, a marked deflection is produced in the galvanometer.

Fig. 11. It has been claimed that a compass or a magnetic dip needle may be used in locating hidden [illegible] but the value only for [illegible] magnetic ores.

Fig. 14. The illustration below shows a laboratory Hughes balance. The coils are placed upon the uprights in such a way that the induced E.M.F. is opposed. A slight sound in the phones is compensated for by adjusting the distance between the coils. When a coin or metal body is now placed near one of the coils, the balance is disrupted and a distinct sound produced.

# Wings for Skaters

In the above diagram our artist has depicted a new form of amusement suitable for the outdoor winter sport enthusiast. It will be noted that the skaters are all equipped with a pair of sails fastened to leather straps. These straps are secured around the shoulders and wrists of the individuals using the same. In order to relieve the upward strain on the ends of the sails two weather belts are used around the waist are likewise attached to the front and back of the sail near the free end. These sails are intended to serve a double purpose. They may be used as the sails of an ordinary sail boat, and by simply shifting them the user can tack into the wind or sail before the wind. Should he gain considerable momentum, the sails will serve to aid him in making long leaps. The device is not cumbersome and may easily be folded up and carried on the hand or stick. The struts of each wing should be of light wood, and the framework should preferably be covered with airplane fabric. The illustration above shows a skater sailing before the wind, another just about to tack, and the other two users negotiating jumps.

—J. Kay London.

# $11,000 for Spirits

More than two years ago SCIENCE AND INVENTION Magazine offered a prize of $11,000.00 to anyone who could demonstrate his or her ability to communicate with the spirits or to give some definite form of supernatural demonstration which in itself was not trickery. During these years we have challenged a great many organizations to produce a manifestation in our presence which because of its very nature, should be entirely free of fraud.

The result has been that mediums and spiritualistic organizations have been afraid to place proofs before us. Those weak attempts which have been made to demonstrate psychical phenomena were almost instantly proven fraudulent, and no medium has dared to come under our observation.

In view of these facts, should we not consider all mediums fraudulent? Should we not consider every psychical manifestation as being trickery pure and simple, intended primarily to fleece those who are bereaved and who find solace in the words from the worst forms of charlatans, namely those who are being permitted to practice upon the poor seeking words from loved ones?

Remember there is nothing in spirit phenomena. Don't let a few amateur magicians fool you in the dark, and don't think because they work in broad daylight that they really communicate with departed spirits.

We have $11,000.00 offered by this publication and Joseph F. Rinn which will be awarded wholly or in part to the one producing a phenomenon devoid of trickery.

**THE $250.00 Rat Trap Contest awards will be announced in the April issue of SCIENCE AND INVENTION Magazine, so if you submitted an entry in this contest look for your name among the prize winners in the next issue.**

# $5,000 for Perpetual Motion

When SCIENCE AND INVENTION Magazine was still in its infancy the editors denied the possibility of constructing a perpetual motion machine out of those forces of nature as we now know them.

Since that time hundreds have received thousands of different designs for perpetual motion devices, and have received hundreds of [illegible] letters soliciting finances for the building of perpetual motion machines.

The editors know that if they receive these letters there are thousands of others in this country who get similar letters and who fall for the claims made in the humbug prospectuses proving absurdly capacities of the various inventions.

Most of the shares of stock for these perpetual motion machines are being sold at a rate of $1.00 per share, although some [illegible] are trying to sell shares of stock at $100.00 per share.

Therefore the editors of this publication say: Let some one and show us money SHOW us a working model of a perpetual motion machine and we will give you $5,000.00. But the machine must not be made to operate by [illegible] steam power, gasoline vapor, sun or humidity. It must be perpetual motion."

So if anyone asks you to buy shares of stock in a perpetual motion machine tell him he can get more money from us and he need only show us the working model. Meanwhile don't you put your money into a device, the working model of which has not even been built and don't invest in any machine which is to be entered in this contest.

# The Moon's Atmosphere

By DONALD H. MENZEL, Ph.D.

## Latest Astronomical Research Indicates Moon May Have An Atmosphere

Fig. 5 above shows the moon about to occult a star which will vanish and then reappear instantaneously after the moon has passed.

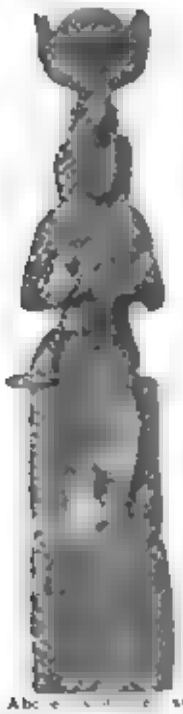
For [illegible] year astronomers have observed [illegible] which have been recorded [illegible] [illegible] [illegible]

CAN THE DEAD BE RE-UNITED?

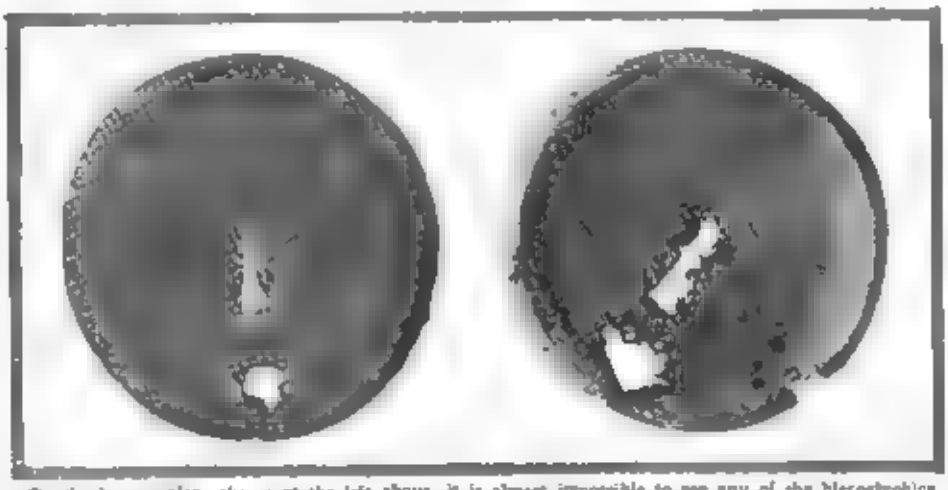
See Page 1088

# Electro-Chemistry Restores Ancient Bronzes

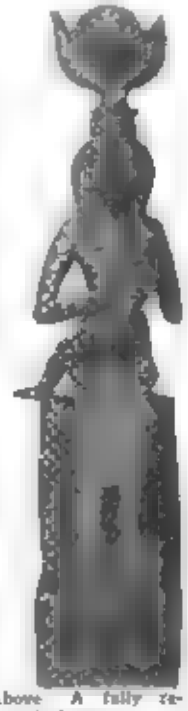
## Crumbling Statues From Ruins Of Bygone Centuries Can Now Be Restored To Their Original Grandeur



Above [illegible] was [illegible] before [illegible] was [illegible] to its original appearance and form.



On the bronze plate shown at the left above, it is almost impossible to see any of the hieroglyphics. However after it has been restored, as shown at the right by the electro-chemical method, practically all of the inscriptions are visible and can easily be deciphered.

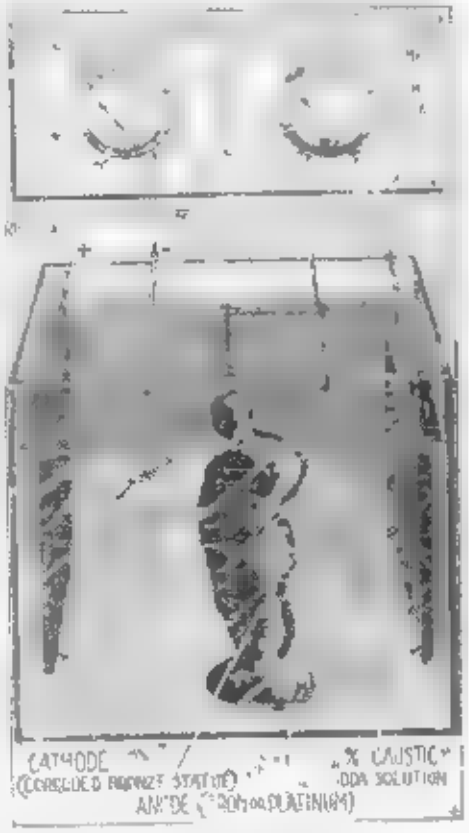


Above: A fully restored bronze statue reclaimed by the electro-chemical method described here.

THE cleaning, repair and restoration of ancient art objects has always been a most interesting subject, but up to the present time the methods that have been followed have been rather haphazard and as often as not have resulted in failure or complete destruction of valuable material. It is obvious, upon consideration of the subject that a good method of restoring bronze objects will be of great interest to antiquarians and museum directors throughout the world, inasmuch as not only statues and other bronzes that have been found in excavations in ancient cities have suffered, but more modern bronze objects are often badly corroded due to exposure to the atmosphere and the elements. The application of acid and other similar corrosive agents to such works of art often is disastrous in results. Mechanical methods of removing incrustations are so crude that parts of the objects are frequently damaged beyond repair.

A study of this subject has been undertaken by Prof. Colin G. Fink and Charles H. Eldridge of Columbia University and the results of their findings have been published [illegible] Museum of Art, in New York City. In essence, the new method that has been discovered utilizes reverse electrolysis. It has been found that in practically all cases, the corrosion on the surface of metal objects is a metallic salt and by an electrolytic method, these salts have been reduced to give their original basic element, that is the metal, and as a result it has been possible to restore corroded metal objects to their original contours, even in the original metal. It has been found that the details of design or workmanship have been preserved and followed exactly by the layer of metallic oxides covering the objects. Over this is usually found a crust formed by electrolytic decomposition and by reversing the process of electrolysis, this crust can be removed, and the oxide reduced to metal.

By following the method described below it has been found possible not only restore partially corroded metallic objects but also to bring those back to their original form that have been wholly oxidized. In other words, even though there is no metal present, the oxide can be changed so as to present the original form. The first step in this process is to hang the bronze object




This diagram shows the details of the electro chemical method employed in restoring ancient bronzes of various types.

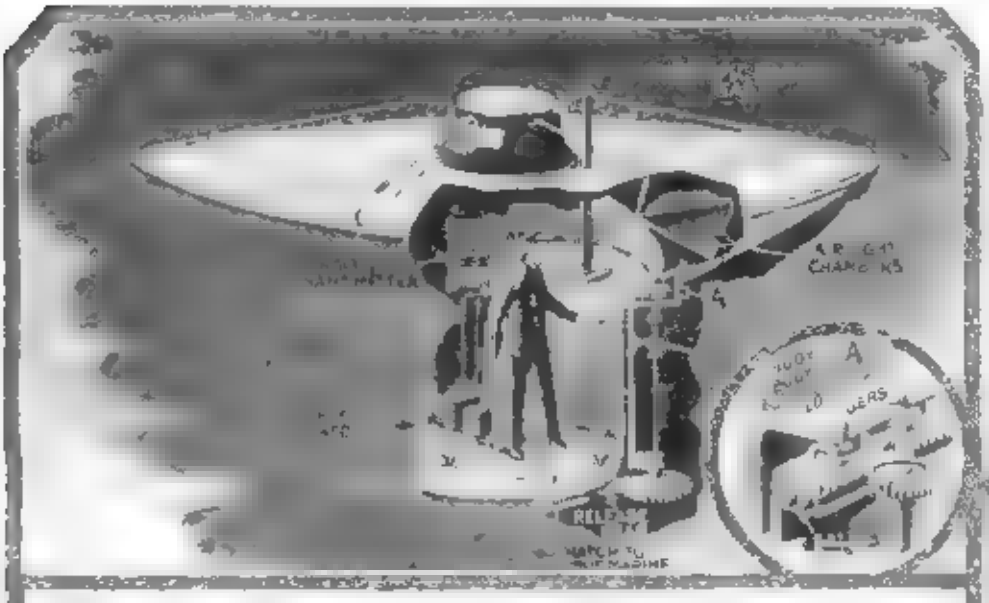
in a 2% caustic soda solution as the cathode of an electrolytic couple, and pass a low amperage direct current through the solution. Two anodes are used, iron duriron or platinum, and they are hung on opposite sides of the object. For small parts 0.1 to 0.5 amperes are employed. By the action of the electrolysis, the crust is reduced to spongy copper. The object is then removed from the solution and carefully washed in warm water. If now there is a metallic base to the object, the reduced spongy copper layer may be removed by gentle brushing. If, however there is no metallic core, the object is dipped into a solution of 1 part of nitric acid to 4 parts of water and into water alternately over and over again, until the reduced outer layer of copper is dissolved. Soon the hard copper oxide surface in which is found the detail of the design is exposed and this surface is found to be almost as hard and smooth to the touch as was the original metallic surface of the bronze.

The various photographs shown on this page illustrate the wonderful results that can be obtained by expert manipulation of the process described above. For instance, note the bronze plate in the illustration at the top center of this page. When originally discovered, this relic was practically valueless because the inscriptions upon it could not be deciphered. When restored by electro-chemistry, there was no trouble whatsoever in determining the exact history of the antique plate.

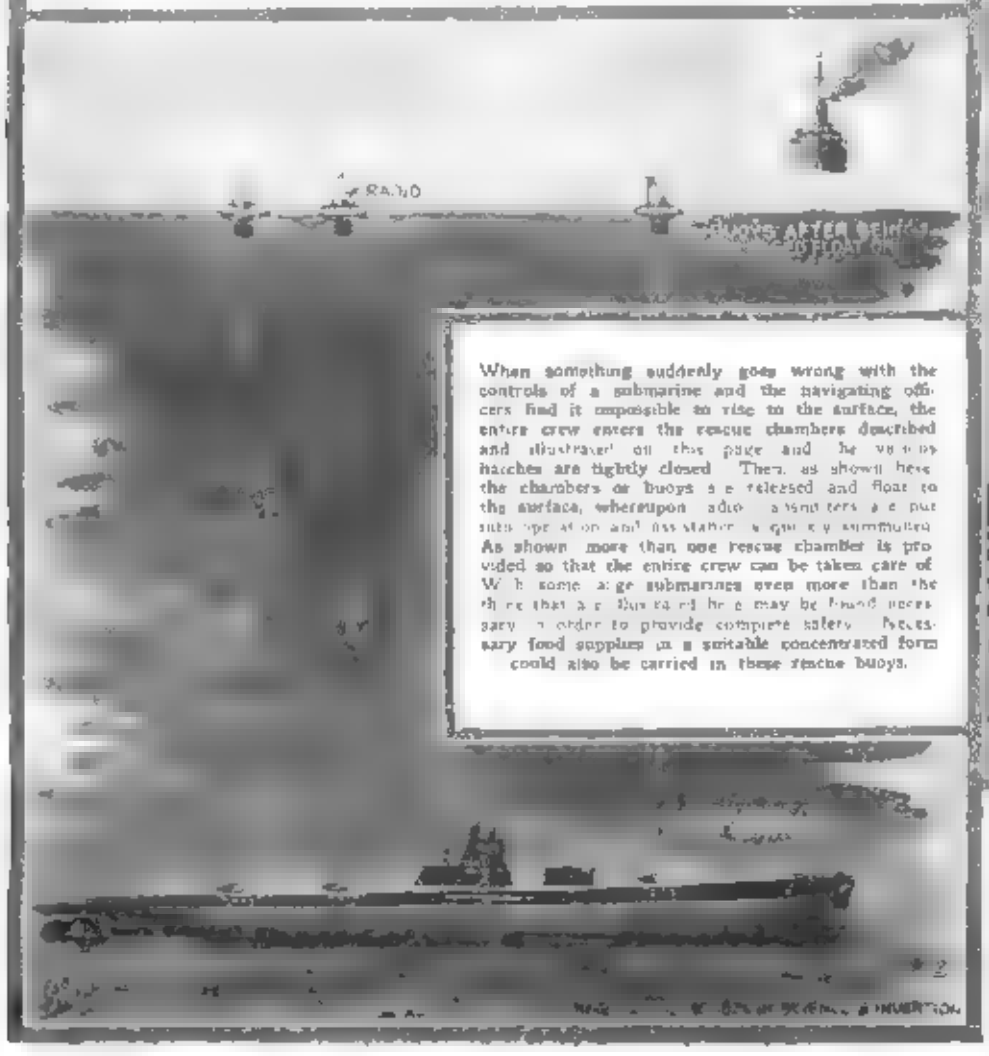
Another example of a restored bronze art object is shown in the above photographs. At the left the destructive corrosion can readily be seen. No details can be discerned. At the right the photograph shows the same piece after restoration showing the complete detail that has become visible throughout the entire structure. —*Photos Metropolitan Museum of Art*

# Safety on Submarines

## Various Devices Described and Illustrated by Means of Which Submarinists Can Escape From Disabled Submerged Vessels




The device illustrated above is so designed and constructed that when fitted on the deck of a submarine it will not interfere with the maneuvering of that vessel in any way. It is firmly locked in place by means of the system shown in the insert A, and when part of the crew of a disabled submarine has entered a lever is pulled and the escape chamber released. This sets one arm which in turn set on a rack and rotate the chamber slightly, thus unlocking the fingers illustrated and releasing the chamber so that it can readily rise. The mechanism is designed to operate on ball bearings so that even if a very tight fit is effected between the chamber and the submarine hull, still the release can be effected quickly and easily.




When something suddenly goes wrong with the controls of a submarine and the navigating officers find it impossible to rise to the surface, the entire crew enters the rescue chambers described and illustrated on this page and the various hatches are tightly closed. Then, as shown here, the chambers or buoys are released and float to the surface, whereupon radio transmitters are put into operation and the station is quickly established. As shown, more than one rescue chamber is provided so that the entire crew can be taken care of. With some large submarines even more than the three that are illustrated here may be found necessary in order to provide complete safety. Necessary food supplies in a suitable concentrated form could also be carried in these rescue buoys.

At the left are shown complete details of a patented type of submarine escape device that has been very cleverly worked out by its inventor and in which practically every emergency is provided for. The chamber which in itself is so constructed that it will float, is designed to be one of several located at strategic points on the deck of a submarine. The chamber is so constructed that when it is entered from below and the hatch is tightly closed, one of the men within it can manipulate certain levers and release the entire chamber from the submarine whereupon it will immediately rise to the surface. The principal details of the mechanical construction of the device are shown in the illustrations at the immediate left. This device was invented and patented by A. J. Griffin.—Patent No. 1,103,958.

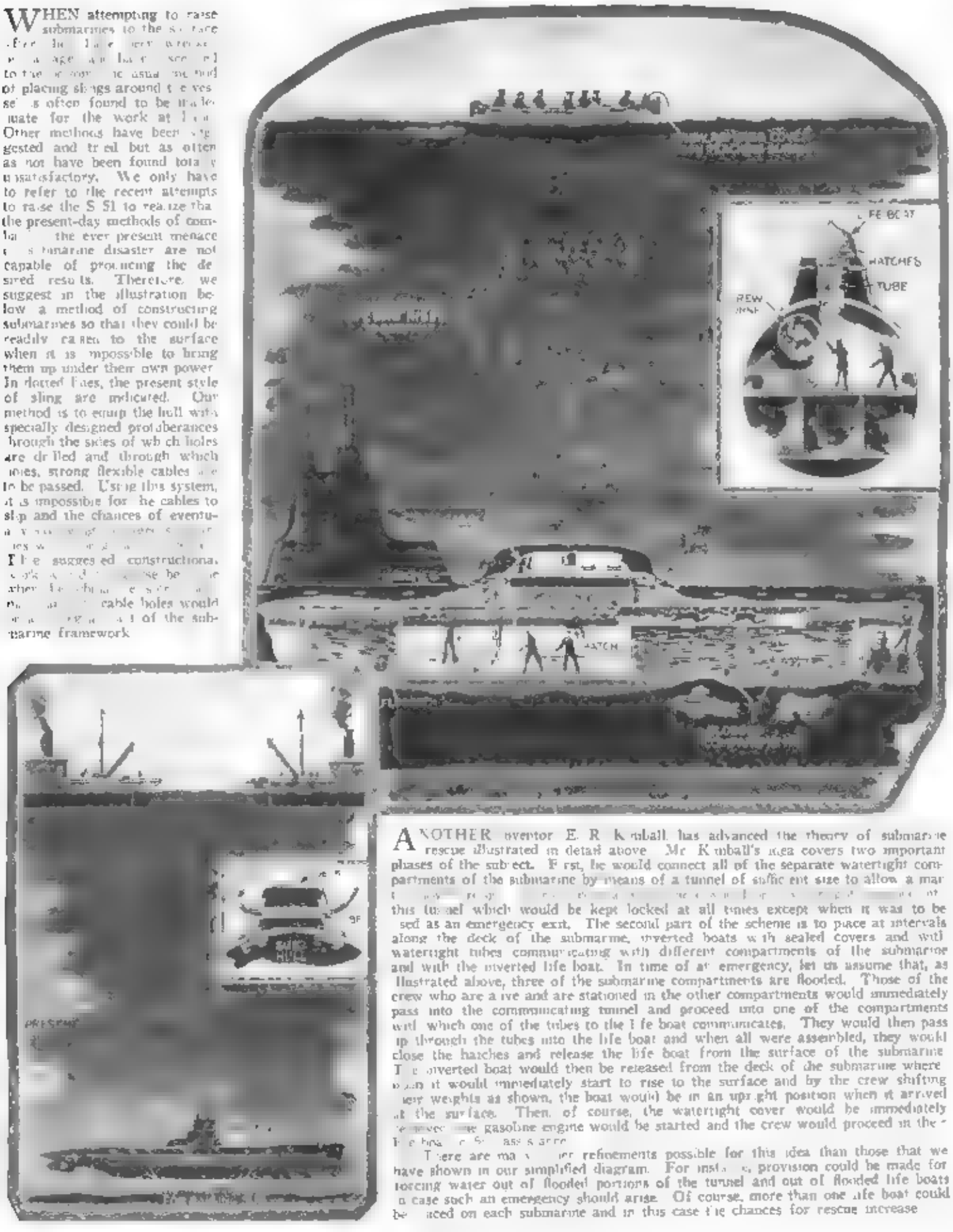
Above: Another type of rescue device for submarines wherein the occupants do not actually escape but are provided with air and with means of radio communication by means of a float that is released and allowed to rise to the surface, carrying a flexible air tube and control wires for a small yet powerful radio transmitter built into the float. When the buoy reaches the surface, collapsible radio masts and air intake funnels can be erected and the navigators of the submarine can summon assistance.
—Lyman Mason

# Due to Several Recent Submarine Disasters, These Rescue Methods Should Be of Timely Interest

WHEN attempting to raise submarines to the surface after [illegible] the usual method of placing slings around the vessel is often found to be inadequate for the work at hand. Other methods have been suggested and tried but as often as not have been found totally unsatisfactory. We only have to refer to the recent attempts to raise the S 51 to realize that the present-day methods of combating the ever present menace of submarine disaster are not capable of producing the desired results. Therefore, we suggest in the illustration below a method of constructing submarines so that they could be readily raised to the surface when it is impossible to bring them up under their own power. In dotted lines, the present style of sling are indicated. Our method is to equip the hull with specially designed protuberances through the sides of which holes are drilled and through which holes, strong flexible cables are to be passed. Using this system, it is impossible for the cables to slip and the chances of eventu-

[illegible]

The suggested constructional [illegible] cable holes would [illegible] of the submarine framework.




ANOTHER inventor E. R. Kimball has advanced the theory of submarine rescue illustrated in detail above. Mr. Kimball's idea covers two important phases of the subject. First, he would connect all of the separate watertight compartments of the submarine by means of a tunnel of sufficient size to allow a man [illegible] this tunnel which would be kept locked at all times except when it was to be used as an emergency exit. The second part of the scheme is to place at intervals along the deck of the submarine, inverted boats with sealed covers and with watertight tubes communicating with different compartments of the submarine and with the inverted life boat. In time of an emergency, let us assume that, as illustrated above, three of the submarine compartments are flooded. Those of the crew who are alive and are stationed in the other compartments would immediately pass into the communicating tunnel and proceed into one of the compartments with which one of the tubes to the life boat communicates. They would then pass up through the tubes into the life boat and when all were assembled, they would close the hatches and release the life boat from the surface of the submarine. The inverted boat would then be released from the deck of the submarine where upon it would immediately start to rise to the surface and by the crew shifting water weights as shown, the boat would be in an upright position when it arrived at the surface. Then, of course, the watertight cover would be immediately removed, the gasoline engine would be started and the crew would proceed in the life boat to [illegible].

There are many other refinements possible for this idea than those that we have shown in our simplified diagram. For instance, provision could be made for forcing water out of flooded portions of the tunnel and out of flooded life boats in case such an emergency should arise. Of course, more than one life boat could be placed on each submarine and in this case the chances for rescue increase

# "Antinoe" Sinking Cabled Across the Atlantic

By H. WINFIELD SECOR, E. E.

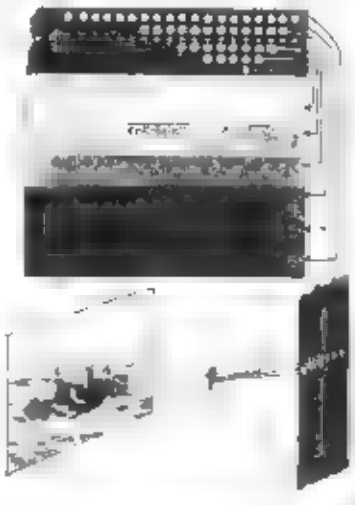
At the left appears a picture of the foundering "Antinoe" as cabled from London to New York over the regular cable system. As shown on the right hand page the perforated tape containing the proper sequence of signals was made in London from the original photo shot of the "Antinoe." As the enlargement in the small circle shows every part of the picture is composed of square dots similar to those of a half tone. These dots are of varying degrees of light and shade and owing to their small size a flashed picture is built up as becomes evident by viewing the accompanying reproduction at arm's length

Photo at right shows machine for operating photo gun as well as preparing transmission tape in New York office of photo syndicate service. Man in center is Captain M. D. McFarlane, who in collaboration with P. G. Bartholomew of the London Daily Mirror developed the Bartlane system of transmitting photos by radio or cable. The pictures may also be represented by telegraph dots if desired. The man at the extreme left of the picture is C. F. Yost of the Bartlane tape system and man at right is F. S. Miller of the Western Union Cable Company. The photo shows first picture being received from London, September 1925.

Map at left shows present facilities for actual operation of transmitting pictures such as Antinoe across ocean and a small part of U. S.

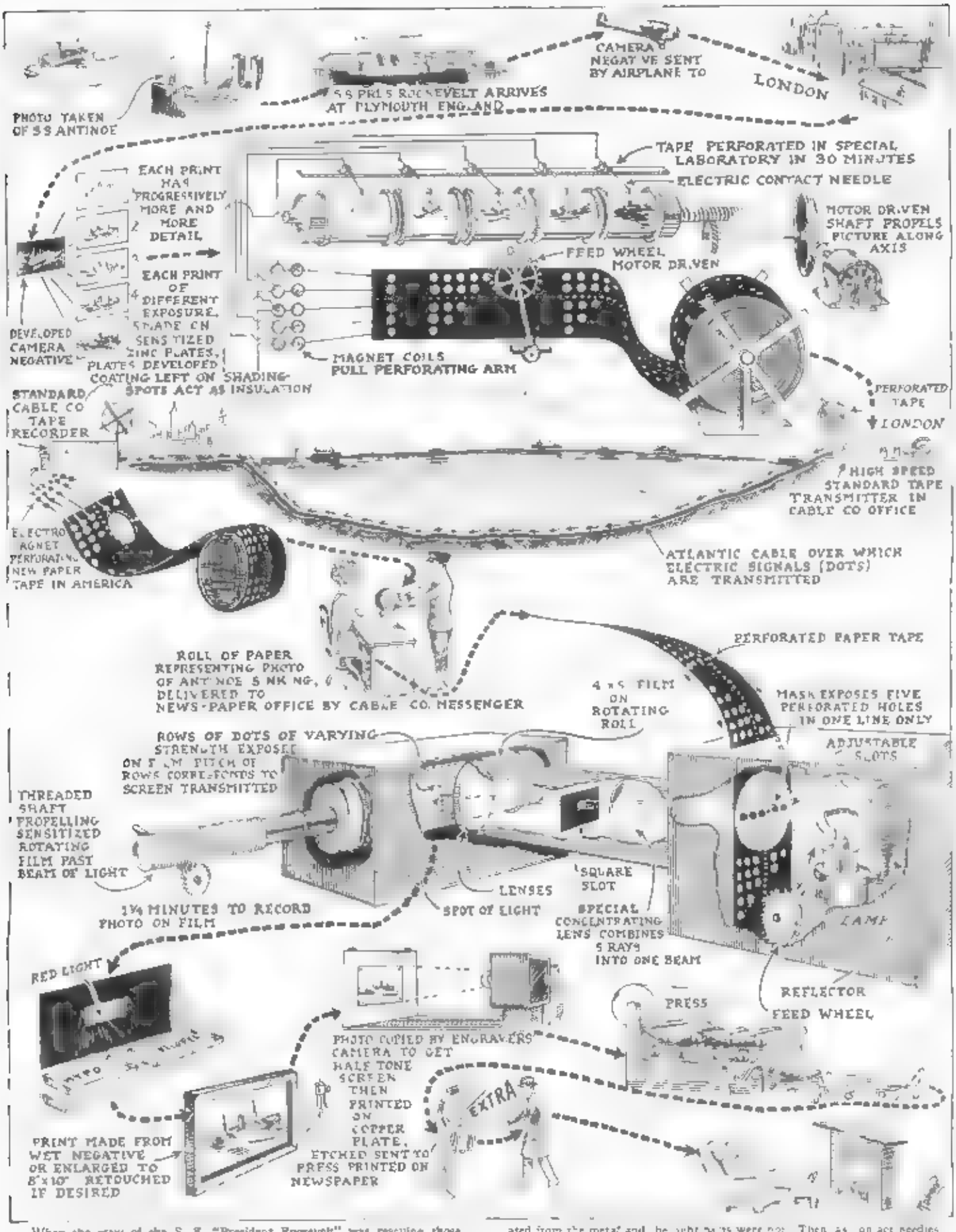
Above we see the smiling face of New York City's new mayor the Honorable James J. Walker as reproduced in London papers from a picture cabled across the Atlantic from New York. Did you notice the picture border around this page? It is composed of five feet of the perforated paper tape a small part of the two hundred and seventy feet of tape required to transmit Mayor Walker's picture across the Atlantic.

The diagram at the immediate right shows the tone scheme employed in this process. It should be remembered to begin with, that no special cable transmitting or receiving apparatus is necessary. The snapshot received in London by airplane from the S. S. President Roosevelt was hurried to the laboratory and five prints on film were made from the negative each of a different exposure giving the five principal tones of light and shadow. There are really six tones obtained in the complete process as the diagram at right shows. The five prints on film each contain parts of shots exposed and an electrical contact is established through these portions corresponding to lights and shadows, each registering on the perforators as shown on opposite page. The cable company receives the perforated tape, transmits it's readings across the ocean, the new tape being delivered to the New York laboratory and reproduced as a picture in the manner shown. A master print is made combining the light rays of the representation to make square dots of varying tone values.



The tape forming the border of this page and comprising a part of Mayor Walker's photo shown above is just one half the width of the actual tape used. It takes a relatively short time to prepare the five tone negatives from the original picture in the transmission laboratory, and the tape signals for photo are transmitted across the ocean in a few minutes. Once the tape is placed in the operating machine it requires but one and one-fourth minutes to record the picture on the film, develop and fix it, and obtain a print from the wet negative.

# How Photos Are Cabled Across Atlantic




When the crew of the S. S. "President Roosevelt" was rescuing those on board the S.S. "Antinoe," a photograph was taken of the latter vessel. This photograph was subsequently sent by cable to the United States for publication. The above illustrations shows the various steps in the transmission. Five prints were made from the negative on zinc sheets. These were then developed and by the process used, the shaded parts were insulated from the metal and the light parts were not. Then as on ace needles were passed over the surfaces as shown circles were made and broken and the tape was perforated. These perforations were then sent in the usual manner, received and recorded. The coded tape was then photographically impressed on a sensitized film in the special manner shown above. From then on the process is plain

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## The EXPERIMENTER

SCIENCE CHECKS
THE SPIRIT MEDIUM

See Page 16

40 RADIO ARTICLES

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RADIO NEWS SCIENCE & INVENTION RADIO REVIEW AMAZING STORIES RADIO INTERNATIONAL

# Science Checks the Spirit Medium

By EDWARD MERLIN

*The Reformed Spiritualist*

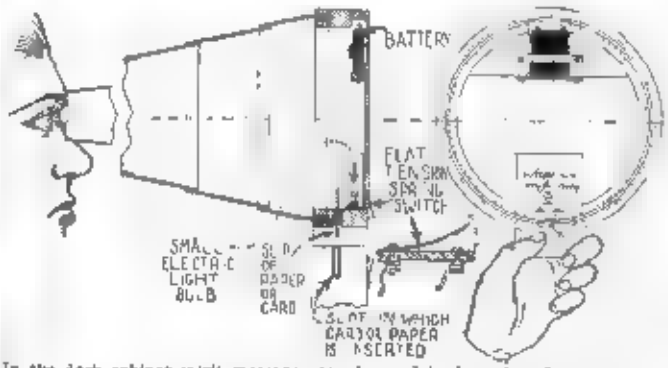
Mr. Merlin has for years given seances. He claims that such a thing as a spiritual manifestation has never been produced and that all mediums that operate for pay are fraudulent. His past articles in this publication show that he knows his work. This is another of the series, and exposes some more of the tricks of these arch fiends preying upon the gullible public upon widows, mothers and orphans. Remember Science and Invention and Joseph F. Rinn still have $11,000.00 which they will pay for genuine phenomena.

If all Spiritual mediums that produced manifestations in the dark were to be painted with luminous paint designs unknown to the mediums and were the paint to be applied to the bare skin such things as manifestations would not occur

ON this page is shown a number of spiritualistic effects which are done by spiritualistic mediums throughout the country. When these methods are illustrated in a magazine article the statement is generally made by those reading the articles that they could never be fooled by methods so crude and simple. The real fact of the matter is that the spirit medium is inferior to the average conjurer when it comes to effects or skill. The medium works in the dark and consequently does not fear detection. She knows that she can get rid of her horns or "gimmicks" quicker than the eye can be accustomed to light and should a flashlight be turned upon her suddenly there would be plenty of witnesses to testify that the horn was in motion when the flashlight was ignited. In every spirit seance care were taken to see to it that only the medium herself produced the manifestations, and if all these mediums were painted with radium luminous signs applied directly to the skin, those signs would in no way impede the manifestations but she would also be able to accomplish any effect without fear of detection. If luminous signs are painted on strips of adhesive tape, the adhesive and can be removed and again replaced.

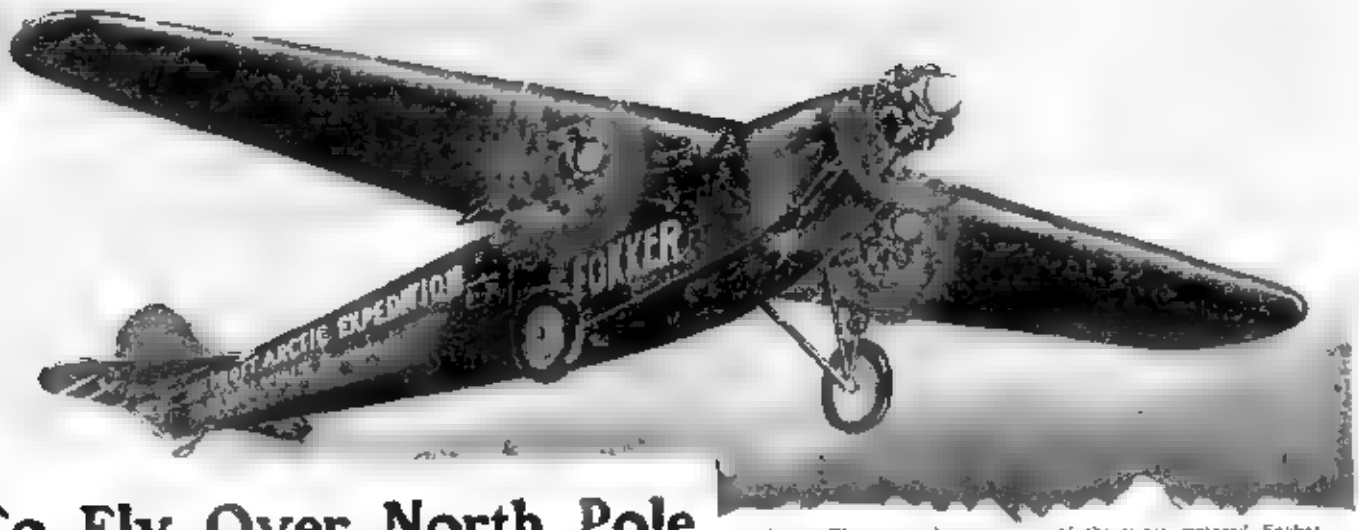
Other effects are explained in the drawings.

In a dark cabinet a medium finds it quite easy to insert a black rubber tube into the end of the horn and cover his hand up with a black sleeve manipulating the hose, causing the horn to move, and talking into the hose whenever he desires.



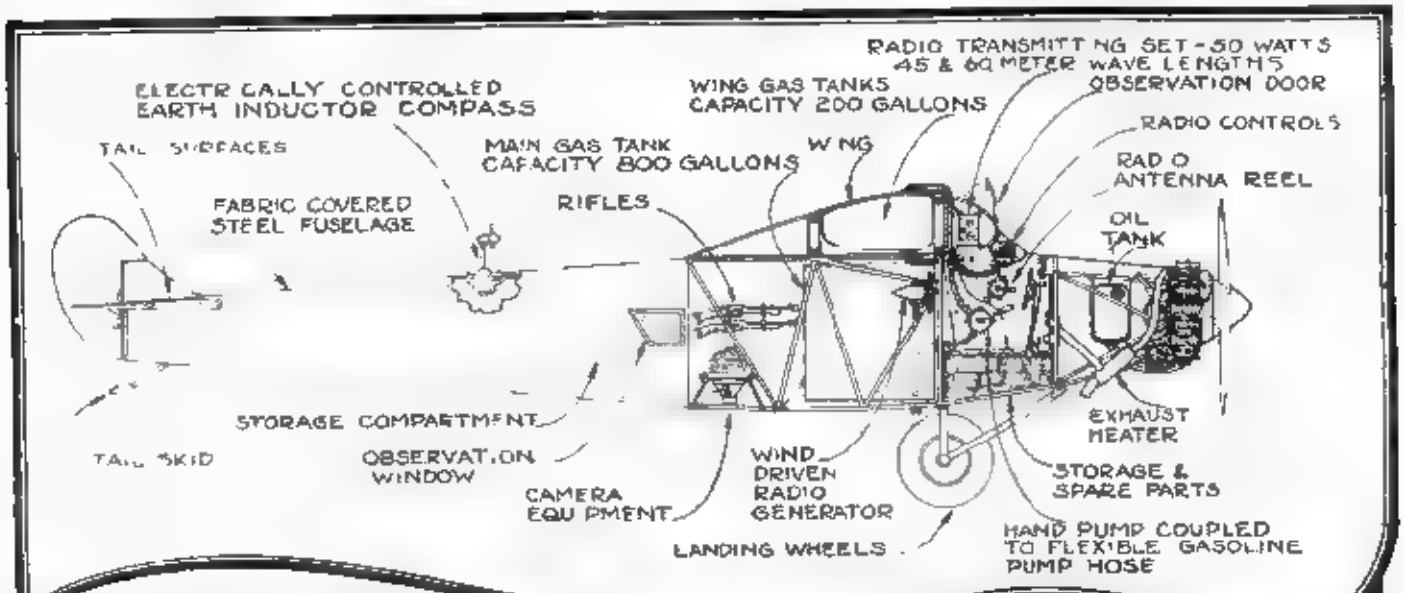

In the dark cabinet spirit messages can be read by inserting them into this light-containing cover for a spirit horn. The envelope in which the message reposes is smeared with alcohol to make the envelope transparent

A medium with a luminous band on each wrist and one around his forehead sits in the position indicated at the right. When the lights are extinguished the bands are removed and placed on the medium's legs as indicated above. A collapsible trumpet is taken from beneath his vest, unfolded, fitted to the suspended trumpet as shown, and serves to direct the voice to the trumpet hung in mid-air

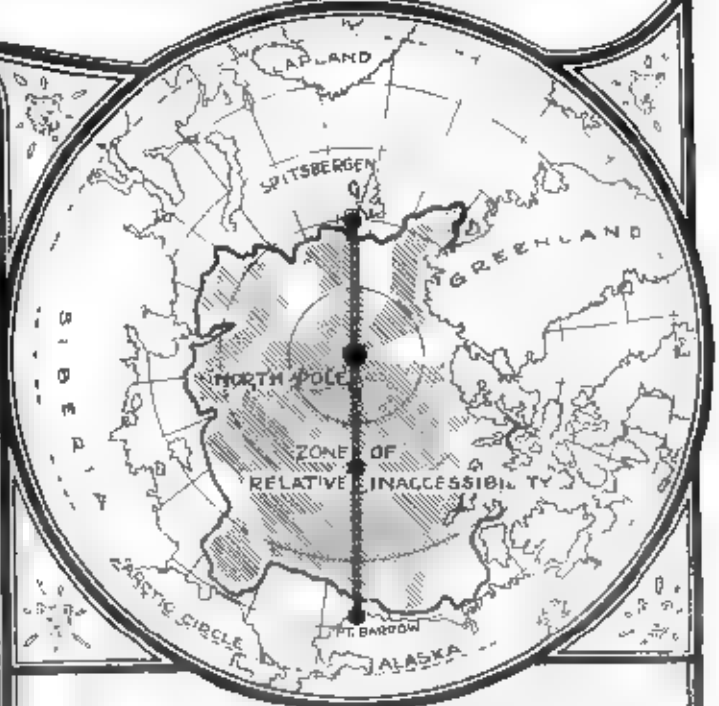



# To Fly Over North Pole

Above The external appearance of the triple motored Fokker plane especially designed for a transpolar flight




Above A cross-sectional view of the polar aeroplane showing the placement of the various flying necessaries and of the fuel tanks Below The center one of the three 200 horse power air cooled motors showing the exhaust heated jacket for supplying warm air to the cockpit Streamline wheels are used wherever possible




Above Accurate map of the polar regions showing by a dotted line the proposed course for the transpolar flight It is expected that on this expedition much information relative to the Arctic region will be obtained, and many photographs taken

# To Conquer Arctic on Wings

By WILLIAM P SULLIVAN, Aeronautical Engineer

SOON a little band of courageous men will begin to explore and study the vast open spaces of frozen and uncon-quered sections of the Arctic Science p s no little part in mak ng possible this ne iod of exploring inaccessible sections in such a short space of time Only a few ars ago, explorers were forced to trave a foot with dog teams dragging heavy loads o provisions and equipment sufficient to last t r months of hardship in efforts to discover some new lands. Their course covered only a narrow strip because their range of visibil-ty was natura ly small due to the fact t is impossible to see clearly for any great d stance from the surface of the Arctic ice

### ENTER AIRPLANE AND MOTOR-SLEIGH

The new method of exploration brings into se the airplane and motor-sleigh. By flying r the section at various altitudes the ob-server can see within a horizon covering miles n a lapse of a few hours, what would have taken an explorer a foot with dog ams years to explore. Hence the a rplane by virtue of its speed and altitude comes into its own as the great means for speedily and visually plac ng the previously unknown regions below the observer in the form of a huge relief map that can be studied and photographed for miles. A number of flying bases can be estab ished. These bases would be used for storing airplanes, motor sleighs, spares, fuel and supplies for e tended exploration. By this method it is possible to explore and accurately map by photography the entire unexplored regions of the Arctic.

Of paramount importance and the first item of consideration is the a rplane which must be specially designed to withstand Arctic conditions and must be capable of fly ng for long distances carrying a large fuel supply and scientific equipment. The Detroit Arctic Expedition under the command of Geroge H. Wilkins is using Fokker airliners, one of which is the famous F VII A three-engined monoplane, which has been stripped of its elaborate cabin furnishings and equipped throughout for the final dash from Pt Barrow directly across the mathematical pole to Spitsbergen, a distance of 2,100 miles without a stop. The Fokker F VII single-eng ne plane, while not having the range of the three-motored plane is equipped for transporting supplies and equipment to any bases that might be estab-lished and maintaining connections with the main land.

### DETAIL OF POLAR AIRPLANE

In designing an airplane for such a long flight and equipping it to cope with the severe weather conditions of the Arctic many problems have to be solved. The first o course, the airplane itself being of the standard Fokker type refers to the gasoline system. The engines are the latest Wright [illegible] the three have an average gas cons mption of 40 gal per hour at cruising speed. This means that for a flight of 2,100 miles at a speed of 100 M P H. the gas capacity would have to be 840 gal. This would enable the plane to start from Pt Barrow fly direct across the pole, and assuming ideal weather conditions, land at Spitsbergen with empty tanks. But many things have to be taken into consideration, such as head winds, which decrease the ground speed and increasing the distance flown by changing the course for exploration purposes and mapping. To cover these conditions an additional 160 gallons were added giving the plane a further range [illegible] 4 hours at 100 M P H [illegible] represent the gas consumption of the three motors at an average of 1,550 revolutions per minute with the plane functioning at its maximum load-carrying condition, but can be considerably increased by the fact that the motors can be throttled back to a slower speed and toward the latter portion of the flight [illegible] two of the motors can be stopped, or left to idle, the plane continuing on one motor at full throttle. The judicious handling of the motors will therefore add several hundred miles to the range of the plane and add to it a condition most essential, that of prolonged flight with one or two of the three engines throttled or possibly stopped by failure

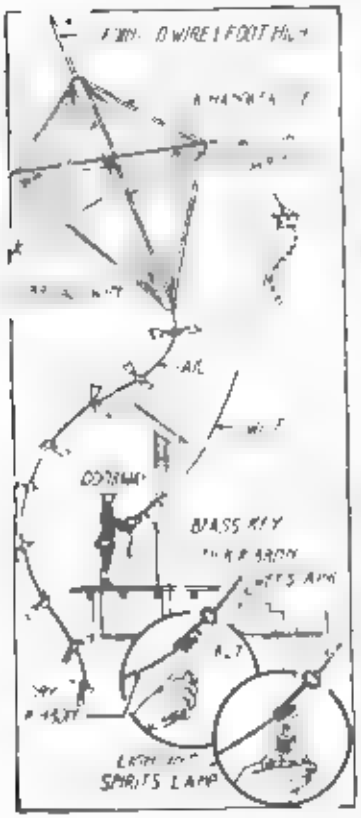
### PLANE'S WINGS CARRY GASOLINE TOO

In the design of the gasoline system, therefore a capacity of 1,000 gallons was decided upon. The two standard tanks of the F V II-A are installed in the wing section and contain 100 gallons each, giving 800 gallons to be carried in a special tank of elliptical shape in the cabin space directly at the center of lift of the plane, so that the balance of the plane will not be changed by the decrease of weight because of the gradual use of this supply which amounts to 4,800 pounds for a full tank to zero when empty

This tank was constructed of terneplate suspended by steel straps from the wing fittings and braced in all directions by similar straps for rigidity. The system for feeding the motors is by gravity from the wing tanks which are continually supplied with gasoline from the main tank by a hand fuel pump situated at the side of the pilot's seat. To insure the fuel lines connecting these three units against crystalization, caused by vibration, rubber gasoline hose is used, which also allows the uncoupling of the lines and connecting them with drums for filing the tanks before flight. All vents and con-

(Continued on page 20)

## Benjamin Franklin's Kite

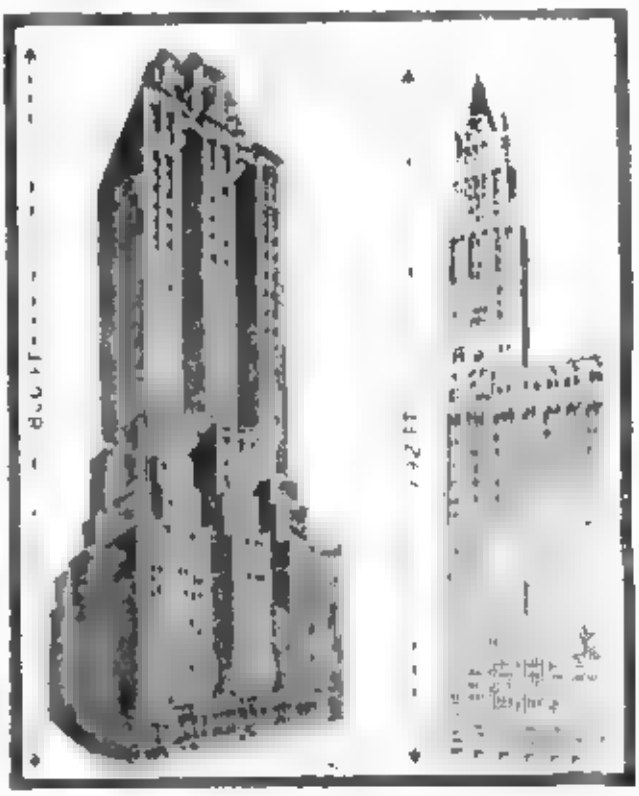



WORK has recently begun on what will be the world's tallest building when completed. It is being erected between [illegible] Streets, on Broadway New York City. It will be 800 feet high, 8 feet taller than the Woolworth Building, as shown in the illustration at the right. This enormous structure will contain a hotel, a church, a hospital and a bank. The architect is William F Lamb.

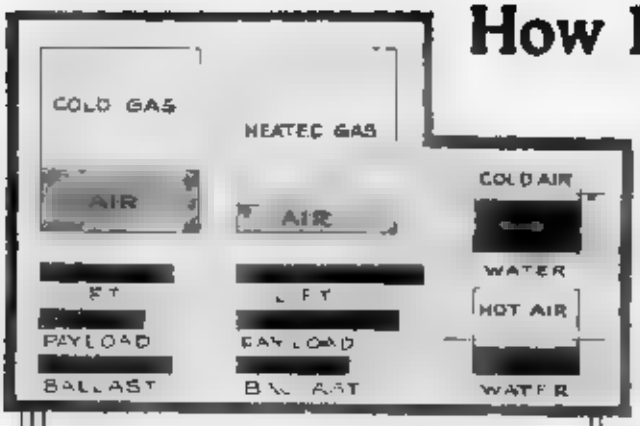
### DETAILS OF THE KITE

A RECENT controversy was supposed to prove that Franklin should not be credited with the famous kite experiment, but investigations have shown that he did actually conduct this work. In a letter [illegible] described in minute detail [illegible] also his experiments with it. The illustration at the left shows how the kite was constructed from two cross pieces and a silk [illegible] for a cover. Where the kite string [illegible] the hand, a dry silk ribbon is attached for [illegible] and the metallic object such as a key is interposed as shown. The wet string outside of the building acts as an electrical conductor and sparks can often be drawn from the key during lightning storms.

## The World's Tallest Building

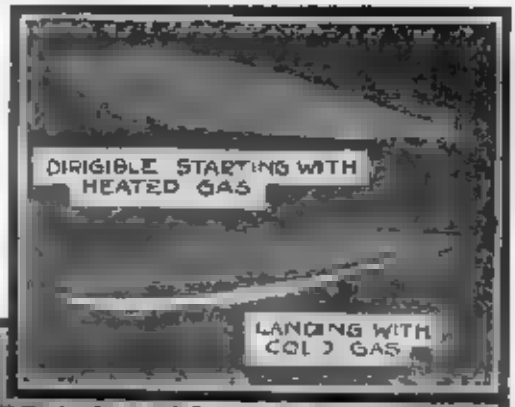


# How Dirigible Gas Temperature Is Controlled

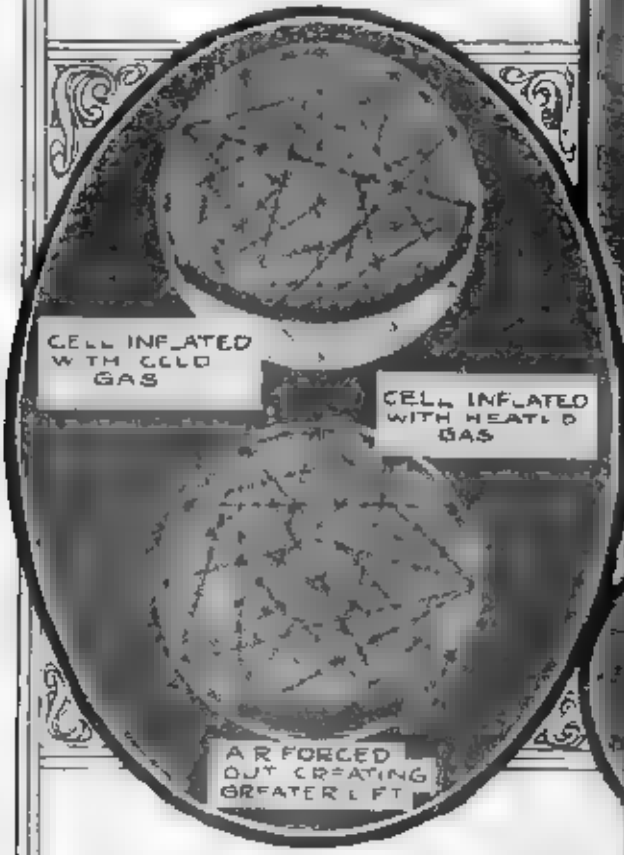



The diagrams above show comparisons between the lifting power of heated and cold gas with the approximate lift, pay-load and ballast required in each case. The right hand diagram above shows the greater buoyancy of heated air.

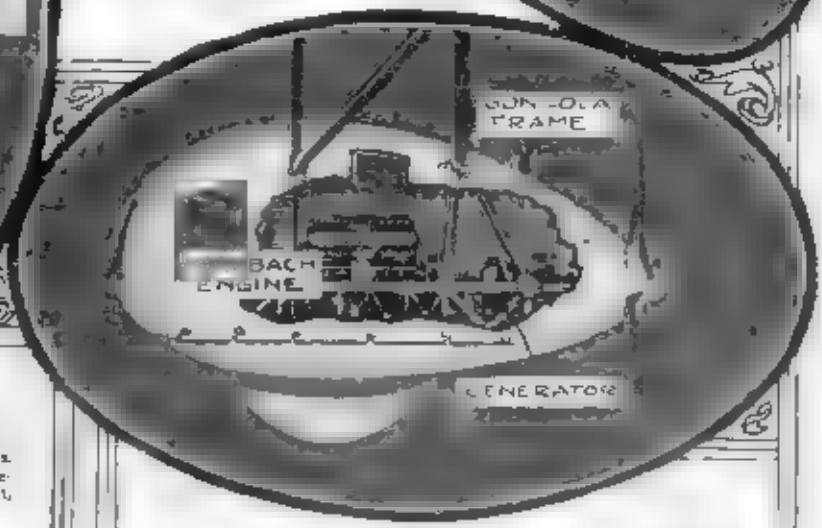
In the two dirigibles illustrated at the right, the shaded portions show the gas while the unshaded parts of the bag indicate the volume of air which replaces the space left by the contracting gases as they cool. Heated gas has greater lifting power.



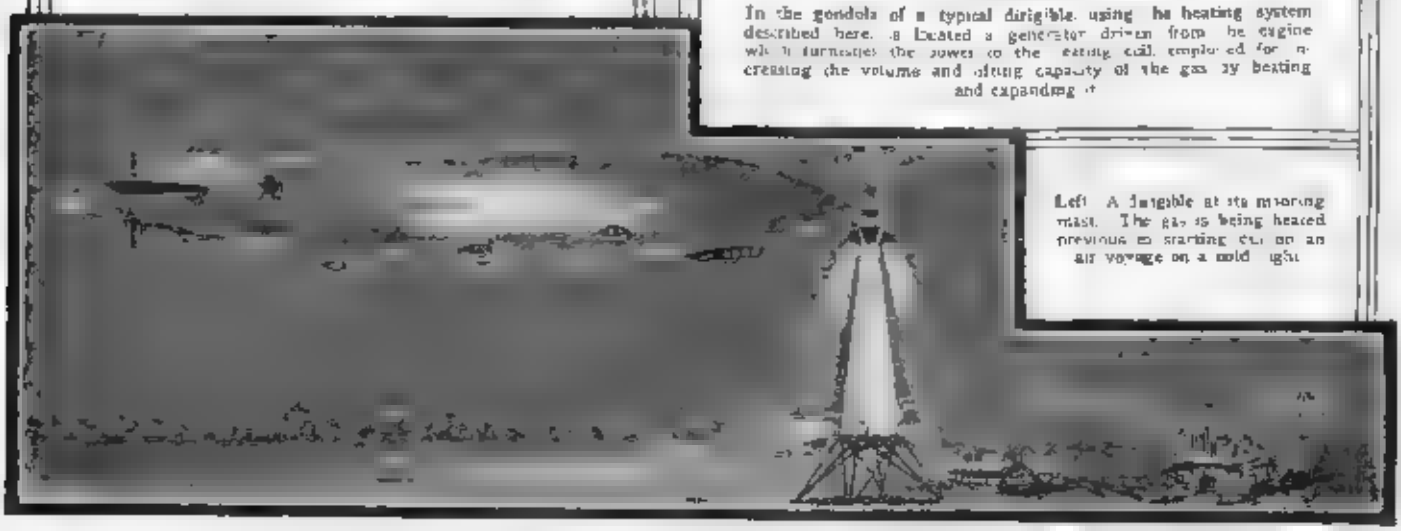
Above—How the gas used in dirigibles is heated or cooled as required.




In the above diagrams, shaded portions indicate gas. Here it is shown how greater lifting power is obtained because of the larger volume of gas created by heating it, using the device illustrated elsewhere on this page.




In the gondola of a typical dirigible, using the heating system described here, is located a generator driven from the engine which furnishes the power to the heating coil employed for increasing the volume and lifting capacity of the gas by heating and expanding it.

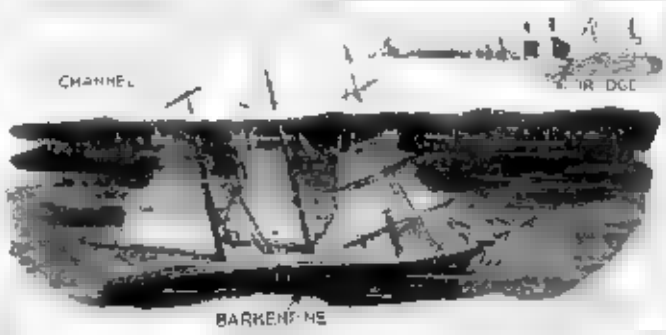


Left—A dirigible at its mooring mast. The gas is being heated previous to starting out on an air voyage on a cold night.

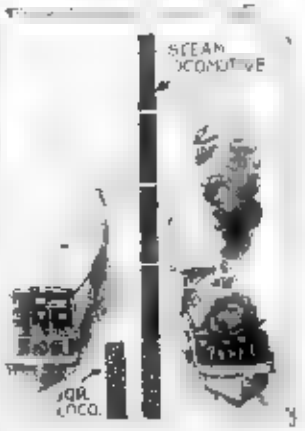
# The Month's Scientific News Illustrated

By GEORGE WALL

An ingenious automobile theft device was the above. As long as the engine is running the lock cannot be released. Consequently the car cannot be started.

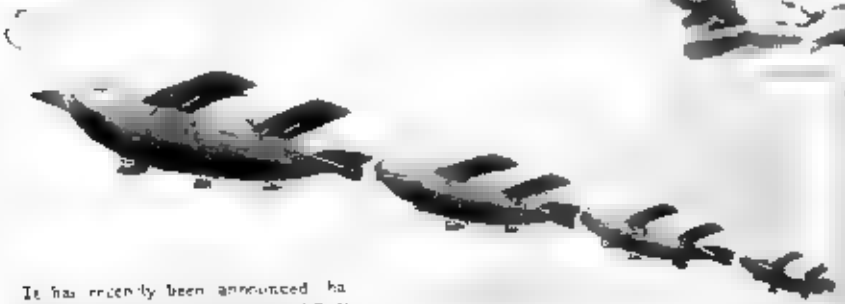



The port at Miami has been recently completely closed by a sunken vessel directly across the mouth of the harbor. A channel for the passage of the ships will be cut around the wreck.



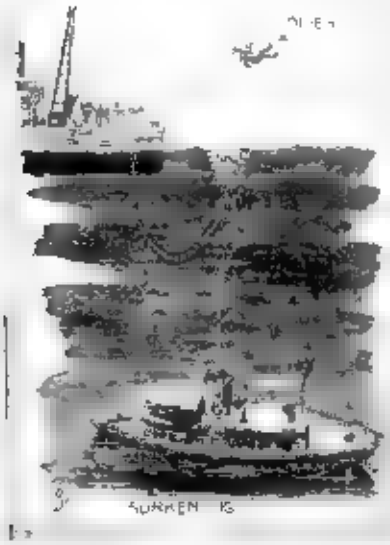

A newly designed electric locomotive for approximately one-fifth as much cost of operation as a steam locomotive

It is planned to utilize the heat developed by the sun in order to blast icebergs. The essential feature are innocuous and easily transported



It has recently been announced that working plans of an aerial ram of dirigibles have been completed. It will be used for blowing holes in ice covered rivers and harbors

A newly designed pay-car for paying off workmen without opening the heads and only envelopes are passed through a slot in the side of a guarded armored car

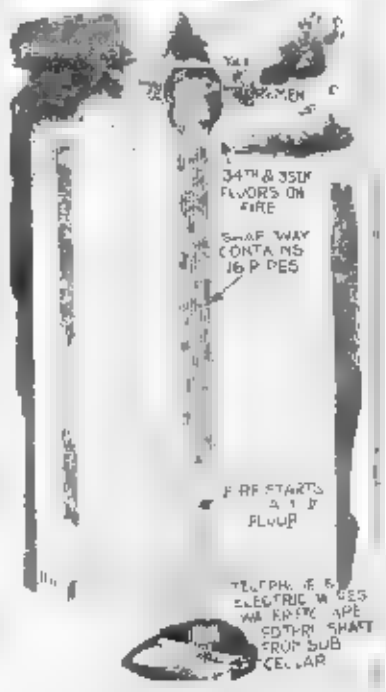



A diver working 55 feet below the surface of the water recently found a hole in the bottom of a sunken vessel on which he was working and became so entangled that he could not get free. His tender immediately opened a control valve and filled his diving suit with 60 pounds of compressed air and the buoyancy lifted him up to the surface, dragging with him the sunken vessel

A dog seeks yawn delayed a ... steamship ... hours. The yawn caused a doctor to believe the animal had been exposed to rabies before he could leave

In this age you can now take a vacation while is proceeding on a business trip and still keep your wife into believing you are at a distant place. A Paris Your Wife Agency will make all schedules, telegrams and prepared letters from various places as indicated above. A nominal charge is made for the service

A fire in the ... Building New York ... floors above the street recently trapped a number of men in a penthouse on the roof. The Fire Department had to fight its fire ... various ... garage ... Their ... way to which ... were confined across the ... and pipes ... paying the building with ... telephone, electric light and water ...




The above diagram shows the way in which the fire occurred and the men were trapped on the roof where the men were ...

RADIO WRNY

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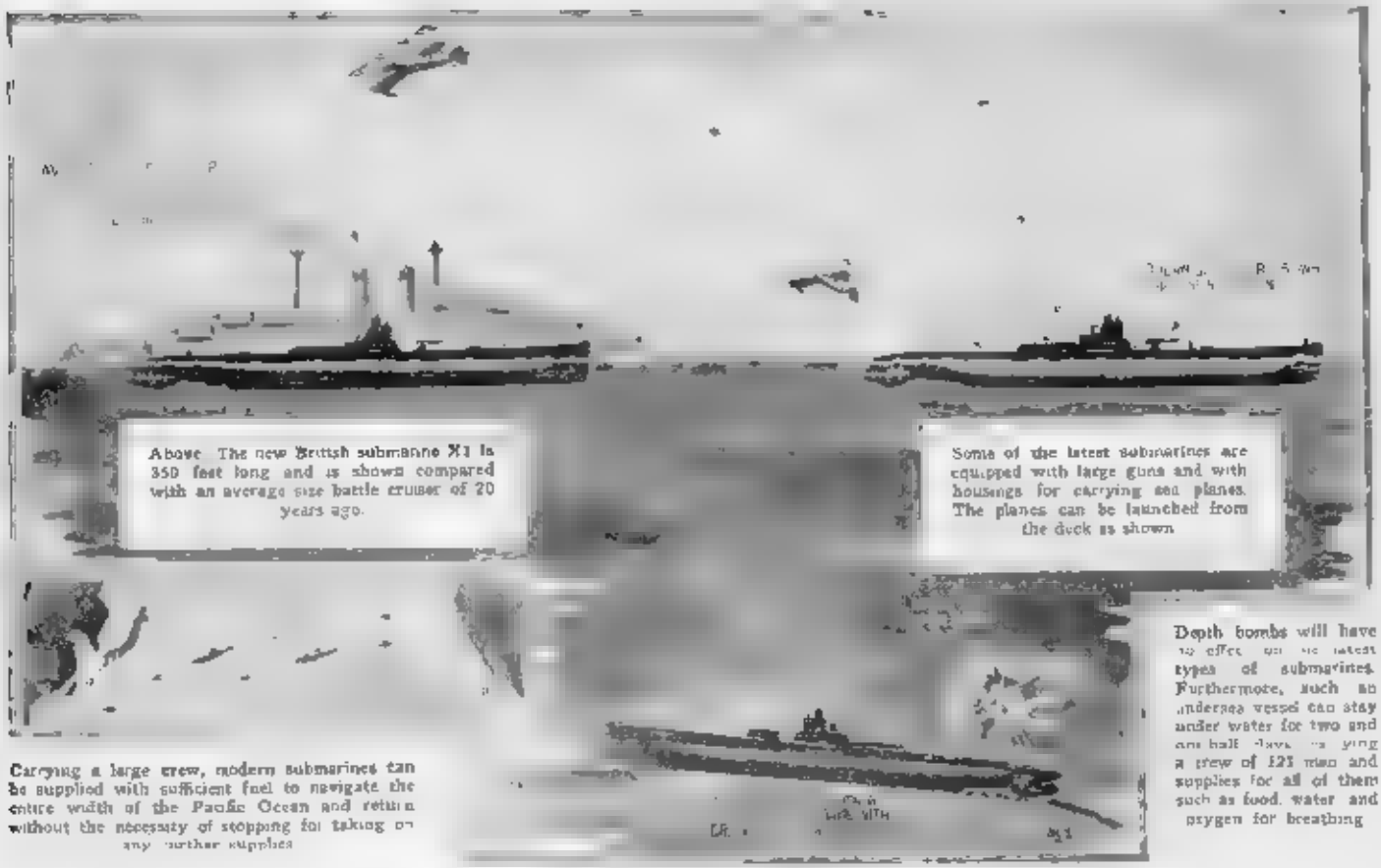
# Science and Invention

(With which is combined)

The EXPERIMENTER

RADIO NEWS — SCIENCE & INVENTION — RADIO REVIEW — AMAZING STORIES — RADIO CRAFT

# New Submarine Has Startling Features



Above: The new British submarine X1 is 350 feet long and is shown compared with an average size battle cruiser of 20 years ago.

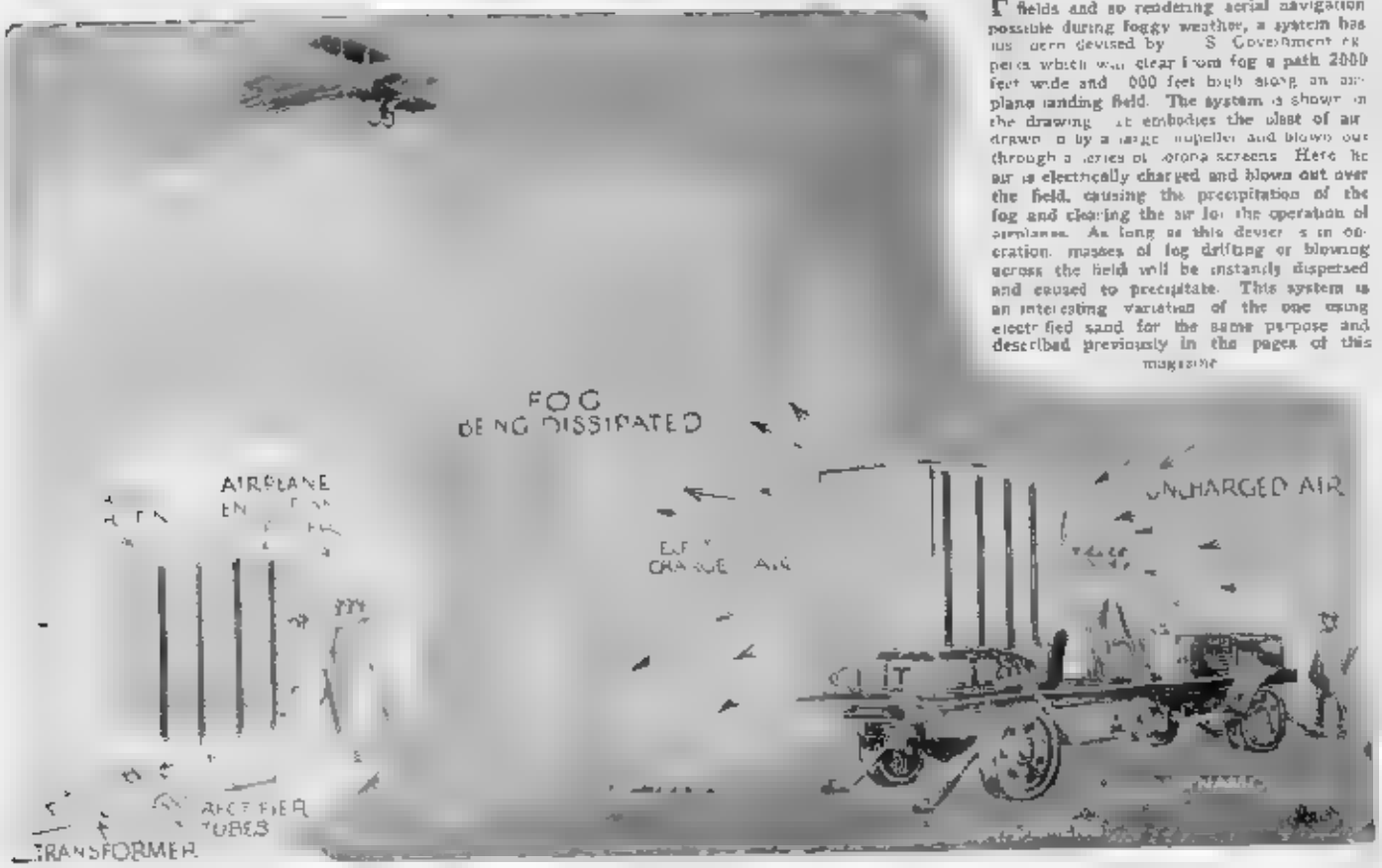
Some of the latest submarines are equipped with large guns and with housings for carrying sea planes. The planes can be launched from the deck as shown

Depth bombs will have no effect on the latest types of submarines. Furthermore, such an undersea vessel can stay under water for two and one half days carrying a crew of 125 men and supplies for all of them such as food, water and oxygen for breathing

Carrying a large crew, modern submarines can be supplied with sufficient fuel to navigate the entire width of the Pacific Ocean and return without the necessity of stopping for taking on any further supplies

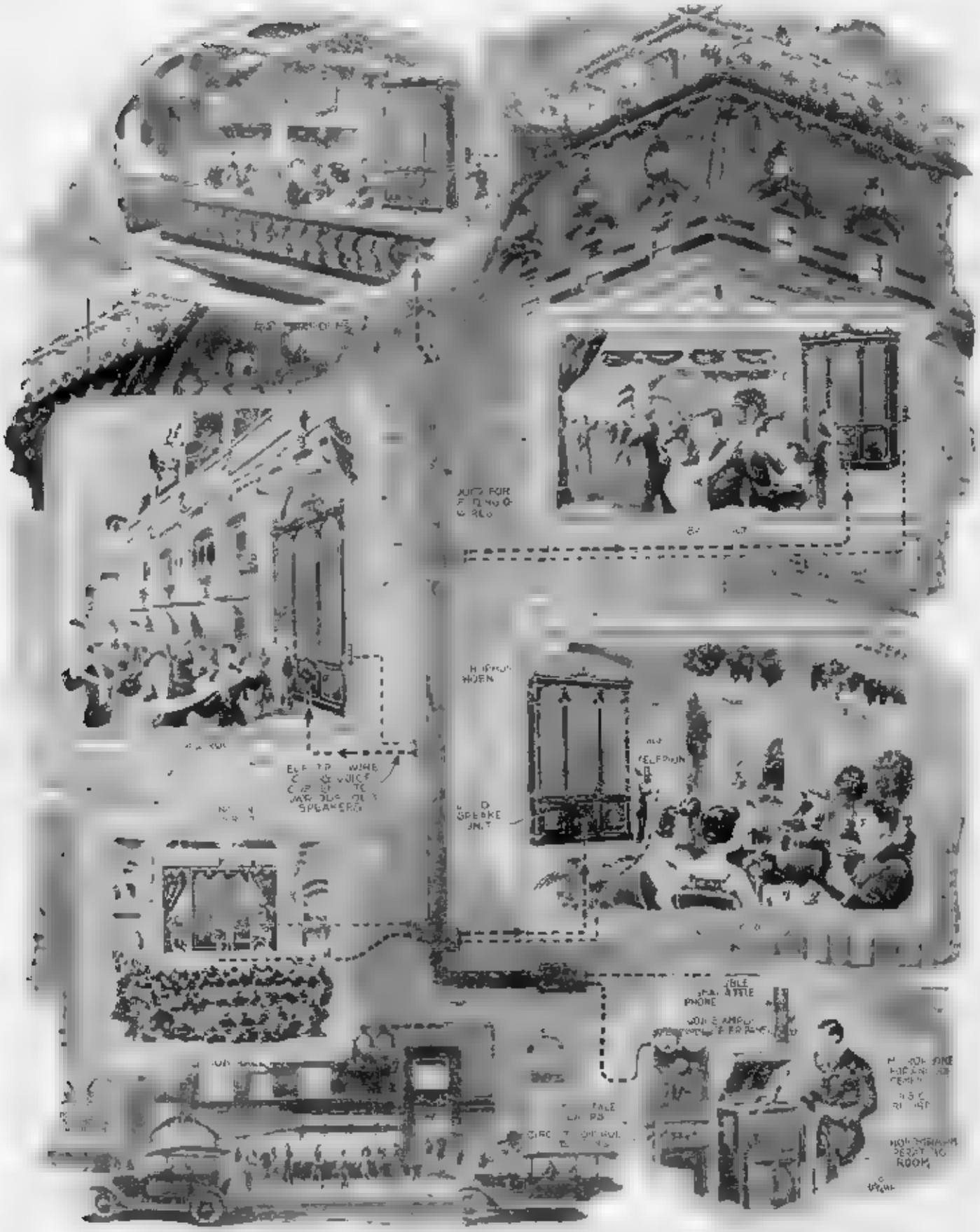
# Electrified Air Disperses Fog

FOR dissipating fog over airplane landing fields and so rendering aerial navigation possible during foggy weather, a system has just been devised by the U. S. Government experts which will clear from fog a path 2000 feet wide and 1000 feet high along an airplane landing field. The system is shown in the drawing. It embodies the blast of air drawn in by a large propeller and blown out through a series of corona screens. Here the air is electrically charged and blown out over the field, causing the precipitation of the fog and clearing the air for the operation of airplanes. As long as this device is in operation, masses of fog drifting or blowing across the field will be instantly dispersed and caused to precipitate. This system is an interesting variation of the one using electrified sand for the same purpose and described previously in the pages of this magazine



# Possibilities of New Phonograph

(How It Would Appear Installed in Hotel Astor, New York City)



A new electrically operated phonograph that has recently been developed to a practical point can be employed for providing entertainment over vast areas. Our artist's illustration above shows the use of this new phonograph in a hotel for providing entertainment to all of the various ballrooms, dining rooms and reception halls. By means of control-boards located at each of these points the music furnished by the phonograph at some remote point can be controlled as to volume and can be shut off or turned on at any time desired. Furthermore the orchestra can be instructed from various points.

# Super-Phonograph Gives Great Volume

## Perfect Tone Control Possible

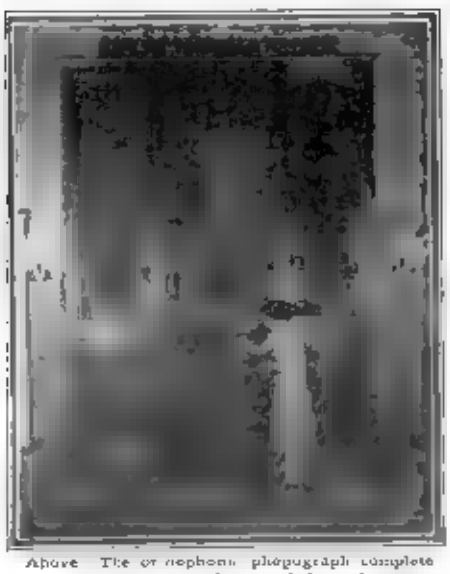
By H. WINFIELD SECOR, E. E

UP to the present time the great difficulties with phonographs have been the inability of the operator to control the volume properly, the fact that the entire tone range cannot be satisfactorily covered and the lack of adequate volume for use in large auditoriums and other places where the volume of produced sound is desired to be as great as that of the original orchestra or other recording medium. In the new orthophonic phonograph developed by the Bell Laboratories of the American Telegraph and Telephone Co., the Western Electric Co. and the Victor Talking Machine Co., all of these troubles have been overcome.

The new machine uses a horn 242 inches long with an opening 80 inches high and 91 inches wide. It uses standard records of the type with which we are all familiar yet by means of an electrical pick-up, the sounds can be amplified to any desired degree so that the volume and quality of orchestral tones can be faithfully reproduced. The frequency range has been greatly increased with this new type of talking machine. With the former ones, the range was from 250 cycles to 4,000 cycles. All of the drums, the real beauty of the bass notes of practically all instruments and the true quality of the lower register of the bass voice, being in the region below 250 cycles were entirely lost in the early type of machine. At the other end of the scale, the high notes suffered due to distortion and blasting and often were lost. Although authorities vary somewhat, it is safe to say that about the lowest note which the human voice is capable of producing is one of 64 cycles. The tuba produces a 40-cycle note, while the pipe organ goes as low as 6, which is little more than an air vibration that is felt rather than heard. With the new orthophonic phonograph practically all of these low notes can be faithfully reproduced. Furthermore, the highest notes of the piccolo in the neighborhood of 4,600 cycles can be as distinctly heard when reproduced by the orthophonic instrument as if the auditor were listening to the piccolo itself.

Above. An orthophonic phonograph installed in a small church, taking the place of the usual pipe organ and rendering excellent results. Note the signalling system.

If the folded horn used in the new orthophonic phonograph were to be extended, it would assume the size and comparative bulk shown in the illustration at left.



Above. The orthophonic phonograph complete with electrical pick-up and large horn.

In regard to the reproduction of piano music, it may be said that the former talking machine could not reproduce fundamental notes below middle C. However, the human ear has the capacity to "manufacture" the lower notes from such overtones of notes below middle C as were reproduced and it was only this faculty that made former types of talking machines agreeable to listen to.

The new orthophonic talking machine in its present form was only produced after a good many years of research. It has been known for some time that phonograph records have much more engraved upon their surfaces than the old type of reproducing instruments could get out of them. Work was then started on methods for reproducing these heretofore unobtainable sounds and improved pick-up devices, sound boxes and horns were tested and experimented with to a very great extent. The horns were found to have a great effect on tone quality and volume and eventually the horn 242 inches long was decided upon as being the most practical.

A short consideration of the subject will show that this newly developed electrically operated phonograph will have many applications. For instance, as pictured on the opposite page, all of the ballrooms and other points of entertainment of a large hotel could be provided with music at all times from a single phonograph located at some convenient point. Thus, the employment of several orchestras could be done away with and ordinary phonograph records could replace them with just as artistic an effect. Then again, the pipe organ of a church could be replaced by one of the new electric phonographs with its accompanying control board and enormous loud speaker horn. The ability of the instrument to reproduce faithfully all of the organ tones would make this entirely possible and in fact very practical particularly in small churches where the installation of a large organ is impossible due to its great cost.

Other applications of this very flexible and adaptable phonograph will immediately suggest themselves. For the rendition of orchestral pieces on any occasion, the phonograph will be useful.

In the above drawing, it is shown how these new aerial torpedoes can be employed for attacking costal cities by enemy landing parties. The torpedoes are launched from any one of several types of platforms and are so set that they will fall and detonate at a predetermined point. Surprising accuracy can be obtained by careful setting of the comparatively simple mechanism that controls them as the article discloses.

# Aerial Torpedo Latest Terror

## Crew-less Aerial Torpedo Controlled by Gyrosopes and Carrying 250 Pounds of TNT Flies 200 Miles at a Speed of 100 Miles Per Hour

By F. E. LOUDY, Aeronautical Engineer

IMAGINE, if you can, the demoralizing effect upon a body of troops of seeing a small airplane emerge from the smoke of battle and, uncannily directed by machinery, approach their territory at a speed of 100 miles an hour, suddenly drop at a strategic point and wreak havoc. Such a scene would have been a common one during the late World War if hostilities had continued for a year or so longer. A new aerial torpedo of great destructive powers had been designed by government officials and, if the war had continued, would have speedily been placed in service. Information has just been released relative to this engine of war and the illustrations on the proceeding page show many of the details.

The pertinent details of this automatically directed torpedo are as follows. The cost of it, exclusive of the explosive used is only $350, whereas the well known Whitehead torpedo for use by submarines and other vessels costs $13,000. Furthermore, the Whitehead torpedo had an effective range of only 20 miles, whereas this new aerial torpedo will travel a distance of 200 miles at an average speed of 100 miles per hour. It carries 250 pounds of TNT and can be started from a small special carriage at any desirable or available point.

Aerial torpedoes can be released from dirigibles hovering over hostile cities when far out of reach of anti-aircraft guns. Tremendous destruction is thus realized.

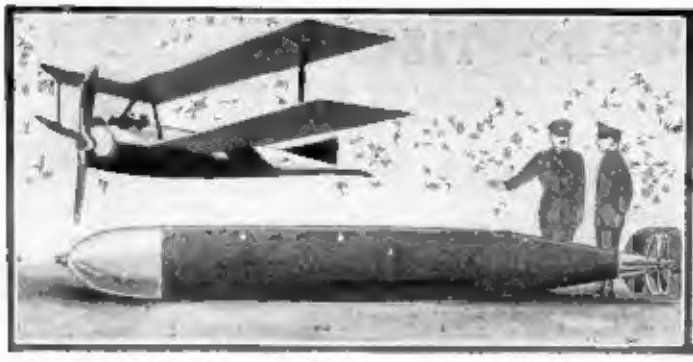
The motive power that actuates the propeller of this torpedo is of a four cylinder V-block type of gasoline engine. It is supplied with ignition current by a storage battery which in turn is controlled by a mileage counter that short circuits the engine ignition when a certain predetermined distance has been covered by the torpedo.

The direction and tilt of the small airplane, the body of which carries the explosive is controlled by means of two gyroscopes. The elevator and rudder controls which operate to keep the machine on a true course are actuated by means of a vacuum system provided with its operating supply by the engine. Altitude and distance of operation are controlled through solenoids supplied with current by a generator attached to the rear end of the engine-crankshaft.

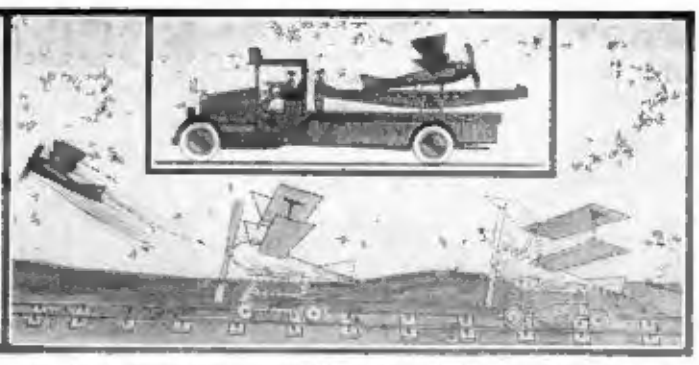
These aerial torpedoes are easily transported from place to place and take up very little room. They can be launched from a very small platform that can be quickly set up or if necessity so demands, they can take off from a reasonably level field. All of the mechanism that controls the flight of the plane is set before the torpedo starts on its flight. The controlling gyroscope has to run at a speed of 18,000 R.P.M. and of course it takes several minutes to attain this speed. It will furthermore run for a period of 30 minutes after the ignition current to the engine is cut off and therefore, the gyroscopic control is active long enough to guide the torpedo safely to the ground at the desired landing point.

The uses of such a torpedo in future warfare can at the present time only be imagined. While the cruising radius of the torpedo in its present form is rated at 200 miles, further refinements and improvements

The utilization of aerial torpedoes in connection with coast-guard guns of large caliber and with scouting airplanes is graphically depicted here. Specially designed projection platforms can be employed for starting these engines of destruction on their journey of death. The man-carrying airplanes can be used for reconnaissance duty for directing the torpedoes.

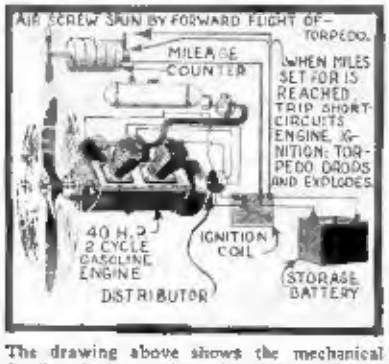


The new aerial torpedo compared as to size with the Whitehead submarine torpedo. In many ways, the aerial torpedo is preferable to the Whitehead. It is cheaper to construct, has a greater range and is far more versatile in its war time uses.



The insert above shows a special launching platform for this aerial torpedo mounted on the rear of a motor truck. The other part of the drawing shows a torpedo being launched from a railroad track. It is carried on a small truck which it leaves upon attaining speed.

in design may increase this radius considerably and so add to the ultimate destructive effect. It is quite possible that the torpedoes may be constructed in larger sizes so as to increase their effectiveness, but even in its present comparatively small size, several can be released at about the same time and thus obtain the effect of one or two very much larger torpedoes. At the present stage of development, the exact direction which the torpedo is to pursue must be determined beforehand and the control so set. If, however, radio control is incorporated, it will be entirely possible to direct the torpedo towards a rapidly moving object and score a great majority of effetive hits. The high speed at which this torpedo can travel will make it a potential weapon for combating enemy aircraft. If its speed can be increased, and there is no reason why this should not be done, and radio control is employed, the fighting flyer of the future may find himself relentlessly pursued by a mechanical demon that cannot be shaken off. The surface of the subject of aerial torpedoes has only been scratched.




The drawing above shows the mechanical details of the engine, the ignition circuit and the mileage counter of this new aerial torpedo.

The launching of an aerial torpedo from the deck of a vessel is illustrated above. The special projection platform is of quite small size.

# How to Know the Value of Patents

By LEO T. PARKER

PATENTS are property. That has been decided on numerous occasions by the U. S. Courts. The value of a patent, however, is another matter. It is true some patents are worth many thousands of dollars and that other patents are not worth a single dime. Now the important thing is to know how to logically determine whether a patent is worth anything and if so how much.

The value of a patent depends upon several things. These things are not so difficult to correctly judge when once an individual understands the simple methods of arriving at a conclusion. First and most important is the length of the unexpired term of the patent. For instance, the term of a U. S. patent is 17 years, and if seven years have passed since it was issued, then the remaining term is ten years. The reason why it is stated that the unexpired term of a patent is most important is that if it is almost expired, the patent's value probably may not justify the trouble, time and expense of investigating its validity with intentions of purchase or of acceptance as security for a loan. If the length of the unexpired term justifies further investigations then it is advisable to request from the patentee or owner of the patent, a complete statement relative to whether or not the patent is already adjudicated in the Courts of the United States. Adjudication means that the patent has passed through one or more courts in infringement proceedings and that its validity has been passed upon.

As a matter of fact the value of a patent is considerably increased, or rather established, if it is adjudged valid in the court proceedings.

While many persons are of the opinion that a patent automatically becomes valid when issued by the Patent Office nevertheless the Patent Office assumes no responsibility and gives any assurance that an issued patent is valid. During the prosecution of an application for a patent, the Patent Office makes as thorough search of the Patent records as is practical, to determine whether or not other patents on similar inventions have previously been issued in this or other countries. If other similar inventions are found, the claims of the patent being prosecuted are required to be limited by the inventor in accordance with the prior patent. Quite naturally the Examiners in the Patent Office are not immune to mistakes and therefore patents are occasionally issued with stronger or broader claims than are justifiable.

Right at this point it perhaps is advisable to explain, for the benefit of those who are unfamiliar with patents, that although the specification or descriptive matter of a patent may thoroughly and completely explain an invention and the drawings may disclose a very complex and unique device, the invention actually patented *is defined in the claims*, which may limit it to only a small part of what is shown and described in the specification. A patent may be granted on minute and unimportant details. When reading the claims of a patent it is well to remember the following simple and certain method or rule of determining whether a claim is effectively broad. If any important element can be eliminated from a claim the remainder of the parts may be built without infringing *that particular claim*. That is the reason a strong claim, usually, is short and brief in its language and contains few elements.

Now to get back to adjudication of a patent. As was previously explained the Patent Office in issuing a patent is not concerned in the matter whether or not other previously issued patents may have claims sufficiently broad to cover the later patents. Moreover, there is no doubt but many patents are issued on similar devices that are mere improvements of the basic patent. And although these many improvement patents may be issued, none of their inventors are privileged to manufacture the improvements without paying a license to the patentee or assignee of the original or basic patent. Of course, the patentee of the basic patent is not privileged to make and sell the improvements which are patented by other persons, but the patentees of the improvement patents are at the mercy of the basic patentee until his patent is expired.

Now when a suit for infringement of a patent is filed against an individual or firm who is believed to be making, using or selling an infringing device or product, there are only two important things for the sued party to do to avoid losing the suit. One is to prove that the claims of the patent do not cover the article he is making, and the other is to invalidate the patent by showing that other devices or articles were in public use or described in a printed publication, etc., before the party bringing the suit actually invented or discovered the device which he patented. In this country no person can obtain or possess a valid patent unless he actually is the first inventor or discoverer of it. Just what the word "inventor" really means re-

(*Continued on page* 179)

# How ANCIENTS Gave "THIRD DEGREE"

The picture shows a rather famous punishment to which we often see allusions in literature. It is even found in classical traditions of olden times. The victim is put into a barrel lined with spikes, and when the barrel is headed up, it is rolled about, the unhappy victim suffering indescribable agony until death relieves him. Imagine the barrel rolled down along a declivity as it has been sometimes described.

This picture represents the famous iron virgin. There were hinges towards the back, so that it opened like two doors, and from its interior a multitude of spikes projected. The victim was stood up within it and the case was closed on him, we may suppose with no gentle hand, the spikes mercilessly entering his body. This is a restoration by the artist. The original is somewhat ruined, and is in Nuremberg.

This shows the ruined instrument as now in the Nuremberg Museum, suggestive even in its present state of dreadful possibilities for the infliction of torture.

Above are shown how criminals were drowned by immersing them in a barrel of water, or it is said sometimes of wine. On the floor they are placing a victim in a sack, so that he can do little to resist them.

On the right is seen an attack on a town. The battering ram is mounted to attack the wall and make a breach therein to admit the attackers, but they have made a prisoner and threaten the townspeople with the first blow upon the wall to annihilate the victim. This was in hopes that the threat would make the townspeople throw open the gates.

There is a satisfaction in seeing the infamous Titus Oates exposed in the pillory. In the court of the equally infamous Judge Jeffreys his false testimony had sent many innocent victims to death. As a part of his punishment he was flogged through the streets of London, receiving thousands of stripes.

Imagine two women who have been fighting, yoked together as shown above, their rage and anger futile and the pair an object of utmost derision to the public at large.

On the right is seen the victim stretched on a St. Andrew's cross, while his bones are methodically broken one by one. One of the bars with which the breaking was done is preserved in Nuremberg. In the background is seen a wheel. Sometimes the victim was fastened on such a wheel for the process and was said to be "broken on the wheel."

# Ancient Torture Methods

By PROF. T. O'CONOR SLOANE, Ph.D., LL.D.

IN the daily papers in the month of Jan. 1926, we are told that in one of the southern states, seventeen masked women went to a house, took a woman out, carried her off to a distance of about three miles, beat her with rods cut from the trees, and went away leaving her there senseless. During the last decade it is not too much to say that scores of people have been burned alive by lynch law in this country.

The history of the murderers, Leopold and Loeb, as it came out in the Chicago court, falls into line with what was stated above, showing how ready or even anxious human beings are to persecute and all this is in the twentieth century, and in America, often called "God's Country," we fear without entire correctness. The desire which seems inherent in the human organization to torture other people, receives almost daily illustrations. Our papers supply the literature of the twentieth century torturing and murdering.

Today, many prominent lawyers, and laymen too, are fighting capital punishment. To them it seems inhumane and entirely out of keeping with our present civilization to employ electrocution, or even hanging—both instruments of speedy death and almost without pain. And these measures are taken only after the criminal is legally tried in a court of Justice and convicted by a jury which has heard all the evidence pro and con. A distinction can be drawn between the ways of a thousand years ago and the present time. In olden times, a certain amount of ingenuity was lavished on instruments and processes of torture, while now, murder, burning alive, and flogging are about all that are used. After the middle of the 19th century, the administration of torture for the purpose of extracting confessions from suspected criminals and witnesses was abandoned, if not in actual application, then at least in form.

Torture even in the dark ages, was not administered entirely without a decided feeling of righteousness, though that may sound contradictory. We find that while there seemed no vestige of conscience or mercy in the infliction of torture for confession or punishment, the judges appeared to have, nevertheless, a profound conscientious scruple or definite legal provision that no one be executed—or sentenced—until he had been proved guilty. And the only conclusive evidence was a confession from the lips of the suspected criminal himself. Practically this confession was considered essential, and torture was applied to obtain it.

The practice of torture dates back to ancient times, and the literature on this subject is surprisingly extensive. We find that for many centuries this practice was regulated by exact statutes of law, varying in the different countries. Several hundred years ago, it was treated by law students in their theses and was generally accepted as the best method to insure a just punishment for the alleged criminal. For the old law designated specifically that no one could be executed without absolute proof of guilt. A confession was conclusive evidence and it was reasoned that the rack, or some other form of torture, had therefore to be applied.

It is interesting to follow the history of "Torture." About the oldest reference is found in the Old Testament, wherein is described flagellation—or beating—punishment by stripes. As it originated, it was merciful, in a degree, for it is definitely stipulated that no more than 40 stripes shall be administered to any one person.

The whip adapted by the Jews consisted of three lashes—one long and two short. In a curious old Latin book is given this description of the whip: the two shorter lashes were made of calf-skin and the long one out of asses' hide, and in the Scriptures, the ass and the ox are both referred to as examples of intelligence. It is said that the double length whip was used in order that the long lash might encircle the body and so inflict its blow on the front, while the shorter lashes strike the back. Every blow was counted as three stripes; thirteen blows therefore resulted in 39 stripes. Since it was strictly against the code to exceed the stipulated 40 stripes, 39 remained the number to be administered. To insure the proper number of blows being given, a certain verse from the Psalm was read. This contained 13 words in the Hebrew, and for each word one blow was given.

And the curious fact about this law is that it was carried out and adhered to for many generations, wherever and whenever flagellation was resorted to. Even in modern times, we read about the American sea captains beating unhappy sailors on board his ship with the stipulated 39 lashes. On merchant ships and whalers his method otherwise was far less merciful than the original. He not only beat his sailors, but tied their hands, extended upwards, to the shroud of the vessel and beat them until they were insensible from agony, without counting the blows.

Flagellation was not the only form of torture used by the ancient Jews. When death was desired, Lapidation was employed. Lapidation — or the killing by throwing stones—was also exactly regulated. The first stone was thrown by a witness and was to strike the victim below the waist. If this proved ineffective, another witness threw a stone, aiming to strike above the waist. If this did not prove fatal either, a community stone-throwing contest ensued, in which the general throng gathered there for such amusement partook. This was kept up until the victim was overcome and died.

"Burning," another system of torture was used somewhat later. Here the victim is choked until he gasped for breath, when molten lead was poured into the unfortunate man's mouth.

In Roman days, torture, which was provided for by law, was supposed to have been restricted to slaves. Theirs was a very extensive system of slavery. Many of these were highly educated, doing secretarial and other high-grade work, but so long as they were of the slave class, they were subject to the tortures inflicted under the Roman administration.

The distinction between punitive torture and torture applied for the purpose of eliciting testimony or confession is quite clear, and

(*Continued on page 177*)

**The above illustration shows the Museum of instruments of torture at Nuremberg, Germany. The reader can spend some time studying over the exhibits. To the right in the back of the room is seen the Virgin, a case lined with great spikes which was opened, the victim placed within it, and then closed upon him, the spikes piercing the body in many places. In the foreground a wheel is lying on the floor. On this a victim was sometimes stretched while his limbs were broken one by one by a heavy iron mace or club. The axe for beheading the victim is seen in the right foreground. It is a dreary exhibit of what the poet called, "man's inhumanity to man."**